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The Board and the Bill

SIR ARCHIBALD PAGE, who is at present general manager to the Central Electricity Board, will take up the chairmanship on the first day of the New Year in succession to Sir Andrew Duncan, who then becomes an ordinary member of the Board.

The news that Sir Andrew's special experience and influence will still be available to the industry will afford deep satisfaction to many electrical men. His appointment has become possible through the resignation of Lord Barnby; without this there would have been no vacancy, as Sir Archibald was not previously a member of the Board.

The new chairman has had a unique practical connection with Britain's electricity supply reorganisation and development policy. His lengthy record in this special sphere impresses one with the variety and extent of his knowledge of the situation as it has changed and of its new problems as they have arisen.

He was chief engineer and manager of the Board for some years, and latterly has been general manager. Before that he had served as one of the Electricity Commissioners in their early days (from 1920 to 1925); indeed, save for a break of two years spent with the County of London Company, he has been with either the Commission or the Board from 1920 down to the present time. It may well be thought that what he does not know about electricity supply is hardly worth the knowing.

The situation, however, is constantly changing, and nowadays, more than ever before, the chairman and his colleagues will be bound to recognise the need for energy and enterprise, as well as broadminded judgment and tact, in facing the problems that confront them in planning the commercial success of the grid scheme and developing its distribution and trade policy.

On the same day that the announcement of the changes in the personnel of the Board was made the House of Commons devoted considerable time to a discussion on the Electricity (Supply) Bill, which has considerable bearing upon powers of the Board. The measure passed its second reading by an overwhelming majority, and it stands referred to a Committee of the whole House instead of to a Select Committee, as some authorities had desired.

The criticism of members of Parliament regarding the raising of loans by the Central Board at high rates of interest were quite ill-founded. Anybody who has followed these financial operations knows that the rates of interest were dictated by market conditions at the various periods when public issues were imperatively necessary to find money for work actually carried out or in hand. Even 5 per cent. failed at one particular moment a few years ago to draw the public, though the underwriters ultimately gained advantage.

Some opposition to the Bill, which was to begin its committee stage on Wednesday, is to be expected, especially to the clauses designed to enable the railways (subject to the consent of the Electricity Commissioners) to obtain supplies direct from the grid, but the Railway Companies' Association has intimated that without these powers no further electrification schemes can be entertained. Presumably the objection to negotiating with a large number of bodies individually would remain even if the intermediary undertakings made no charge for their services, and any anticipation of loss to the latter would thus be merely illusory.

The desire to avoid an appearance of adopting a dog-in-the manger policy in these circumstances no doubt accounts for the decisions of the National Consultative Committee, the Incorporated Municipal Electrical Association and the Association of Electric Power Companies to offer no opposition to the Bill.

The South-West England Tariff

THE effect of relatively long lengths of transmission line is shown in the grid tariff for the South-West England and South Wales Area. While the fixed charges (which range in four steps from £3 10s. to £2 15s. per kW of m.d.) are the same as in three of the four areas in which trading has begun by the Central Electricity Board, the variation for

each shilling by which the local rates are above or below 4s. 6d. per kW installed in the selected stations is more than 10 per cent. above the variation standard elsewhere. The running charges at 0.225d. per kWh are also higher, partly on account of transmission losses, but mainly, it may be presumed, because of the smaller stations selected; they are based on coal with a calorific value of 12,700 B.th.u. per lb. at 14s. 6d. per ton compared with from 11,000 to 11.600 B.th.u. at from 13s. to 16s. per ton in the other areas in which the running charges vary from 0.186d. to 0.21d. per kWh. The allowance in the new area of 0.0008d. per kWh for each penny variation from basic price is the same as in South-East England.

Direct Competition

THE hitherto dimly lighted streets of Carnforth will in future be illuminated on a scale more in accordance with modern needs. In deciding to accept the offer of the Westmorland and District Electricity Supply Co., the Urban District Council was influenced by the lower cost of the Johnson & Phillips electrical system (apart from the much better illumination it will give) compared with that of the gas undertaking with its latest fittings. This success in direct competition with gas at its strongest point as a lighting agent follows the completion of eight other J. & P. schemes in the company's area of supply. Further developments are expected, as even the smallest villages in Westmorland are showing considerable interest in good street lighting—an indication of what is possible in a newly opened area of predominantly rural character.

Consolidation of Distribution

THE present consensus of opinion of the industry regarding the future of distribution is probably that expressed by Mr. R. P. Sloan at the I.E.E. South Midland Centre dinner at Birmingham. He urged that the present parochial system of over 600 undertakings should be replaced by distribution areas of economic size controlled by those who understood the local requirements. The problems of distribution differ in important respects from those of generation and do not lend themselves readily to centralised control, but that there is an urgent need for the adoption of underlying technical as well as administrative principles was clearly shown in Mr. L. Romero's paper at the last I.M.E.A. Convention. Mr. Sloan's views seemed to be in general agreement with those expressed by Mr. E. E. Hoadley at the recent E.P.E.A. dinner in his plea that the industry should be allowed an opportunity to prepare its own scheme. Whatever method may be ultimately adopted it will be, as Sir Archibald Page said of the grid, an instrument for the industry to use for its own benefit.

British Plant Only

AN interesting episode is recorded in our news from South Africa. When the Town Council of Worcester, Cape Province, invited tenders for plant it stipulated that it should be British-made, the preference being due to the desire of Mr. Mann, the electrical engineer, to secure the best and most suitable for the purposes of the undertaking. At the appearance of opposition, because of too much preference for British goods, the Council at first showed some hesitation, but the emphatic restatement of the engineer's convictions and desires led the committee to repeat its support of his recommendation, and British plant is to be installed.

A Coming-of-Age

WE have tried to catch the atmosphere of 1913 by referring to the volumes of the ELECTRICAL REVIEW for that year, and we find ourselves rejoicing in the then "prevailing prosperity" and "great activity" of the industry. Our reason for looking back is that it was in that year-before-the-war that the now so well-known switchgear manufacturing business of Messrs. Ferguson Pailin began operations at Manchester with a staff of two. The coming-of-age celebration took place on Monday at Manchester, when Mr. S. Ferguson presided over a large gathering of gentlemen representing various branches of the industry. The birth and growth of the concern and the proceedings at the dinner form the subject of an article published on page 783 of this issue. Mr. Ferguson remarked that the success of an enterprise was realised when it recognised that it was responsible not only to its customers but to its proprietors and its employés, and reconciled the claims of all three. We congratulate the company on its birthday, and hope that the state of business twenty-nine years hence will enable it to report, on the occasion of its jubilee, a growth of employment between 1934 and 1963 as gratifying as is that experienced to-day, when, after twenty-one years' work, the figure stands at 1,500.

Closed Stations

REPLYING to a question in the House of Commons last week, the Minister of Transport said that since the commencement of operations by the Central Electricity Board up to the beginning of this year over 150 power-stations had been closed down—not necessarily as a result of directions by the Board. It will thus be seen that, even when due allowance is made for new stations which have been put into commission, there has been a substantial reduction in the number. It is impossible that this has taken place without displacing men, but we have heard so little about this that we are encouraged to hope that useful employment is being found on the distribution side for those whose jobs have been abolished by bulk supply arrangements. As we have said before, the rapid expansion of electricity supply must provide work for ever-increasing—not declining—numbers. Power-station men should, therefore, endeavour to get a thorough knowledge of the outside work of their undertakings, to fit them for the new conditions which are inevitably arising.

Fluidity and Mobility

WARNINGS against specialisation too early in a career have been given from time to time by our educational authorities on the ground that a broad basis of culture is required to relate our experiences to those of other workers. Sir Arthur Huddleston, at the I.E.E. Scottish Centre dinner, drew attention to a further reason for methods of training designed to promote "fluidity and mobility" in view of a possible shifting of the centre of gravity caused by new developments. Electrical engineering is evolving rapidly in its practical applications; the rate of progress is likely to be accelerated, as its raw material is the illimitable field of physics. The President, Professor W. M. Thornton, also emphasised the need for mental flexibility in calling upon young men to observe well, so that their contributions to the common stock may be freshly minted. There is always a need for "first-hand" people.

Our "Magnificent" Pylons

So frequently have we blushed with shame as we have listened to the vilification of electric pylons that we now emerge beaming with pride and joy as we read that Dr. Cyril Fox, Director of the National Museum of Wales, told parents and scholars on "speech day" at East Dean Grammar School that "the great pylons that stretch over the country under the electric grid system are "magnificent," and are among the beautiful things in our modern world that some people say are ugly. Dr. Fox, no doubt, would be the first to find sermons in stones, for he finds beauty in the New York skyscraper, and says that only intolerant people think it ugly. Unfortunately, at the same assembly Sir Russell Kerr dared to tell the rising generation that he did not share Dr. Fox's admiration for pylons and skyscrapers! There you are again—that's just how things happen—somebody *would* say that!

Variable-speed Drives. By C. W. Olliver

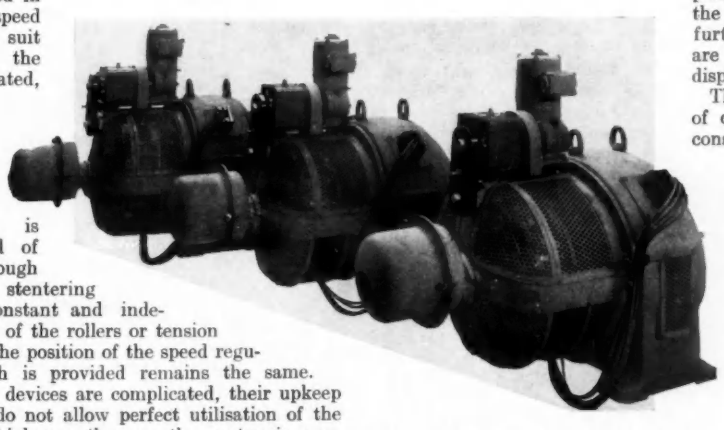
Some applications of the commutator motor

IN a recent article I reviewed recent developments in the technique and design of a.c. commutator motors and made general reference to their applications. This article deals more definitely with the use of these motors in a number of industries.

A.c. commutator motors have been used in great number in the textile industries, especially to drive ring-spinning frames and doubling frames (where the constant speed of the shunt motor as compared with the series type is of great importance), cloth-printing and finishing machines, wringers, &c. They are also extensively used in dye works where the speed has to be adjusted to suit the working process, the quality of the stuff treated, or the desired finish.

Usually a finely graded range of speed regulation of not more than one to three is called for; individual drive is used. Thus the speed of the stuff passing through the calender, wringer, stentering frame, &c., remains constant and independent of the pressure of the rollers or tension in the stuff, so long as the position of the speed regulating handwheel which is provided remains the same.

Mechanical regulating devices are complicated, their upkeep is expensive, and they do not allow perfect utilisation of the machine driven. The higher outlay on the motor is very quickly saved in service and its use is all the more justified by reason of the high cost of the machine driven.



Commutator motors for lift duty, 30/8 h.p., 960/240 r.p.m. (B.T.H.)

Paper Making and Pumping

The numerous processes in paper manufacture requiring a variable-speed motor include paper-making, reeling, cutting, calendering and drying. All the machines involved in these processes can be advantageously driven by commutator motors. Paper-making machines on a.c. systems have hitherto required most elaborate driving units. The need for absolutely constant speed at any load necessitated the use of Ward-Leonard machines with their attendant losses, which occupied valuable space. The super-calender for newsprint can be driven at the maximum speed possible without causing undue paper breakage; this speed depends on the quality and strength of the paper, hence the necessity for using a variable-speed motor.

Commutator motors are very suitable for dealing with certain pumping problems. For example, in a pumping equipment supplying hydraulic power for operating lifts in conjunction with an accumulator, the rise and fall of the latter operates the brush-gear of the motor through chains, so that the motor is accelerated when the reserve power is small, and decelerated when the accumulator is charged. The motor thus increases the capacity of the equipment for a given size of accumulator and minimises the number of starts and stops that have to be made.

For borehole pump drives, an approximately constant quantity of water has usually to be pumped against a total head which varies with the water level in the well. The pumps must be run at varying speeds, and since the water levels often vary considerably, they may have to run at low speeds for long periods. The high efficiency of these motors at all speeds makes them the most economical for the duty.

A recent installation, illustrated on page 781, includes two vertical B.T.H. commutator motors each 420/250 h.p. at 810/645 r.p.m. which have to pump 1,000 gallons per minute against a head varying from 570 to 670 ft. and maintain a p.f. of not less than 90 per cent. throughout the working range.

A further example illustrated shows the Brown Boveri pumping motors installed at the Giessliweg station in Basle. This is a draining sewage pumping station, in which the volume of sewage water to be passed in the twenty-four hours varies considerably, and it is desirable that this volume of sewage shall be passed as quickly as possible in order to prevent fermentation.

This pumping plant is completely automatic in operation, two commutator motor-driven pumps being used to take care of the variations in output and head. Switching in takes place with the brushes in the zero position, and the further starting operations are accomplished by brush displacement.

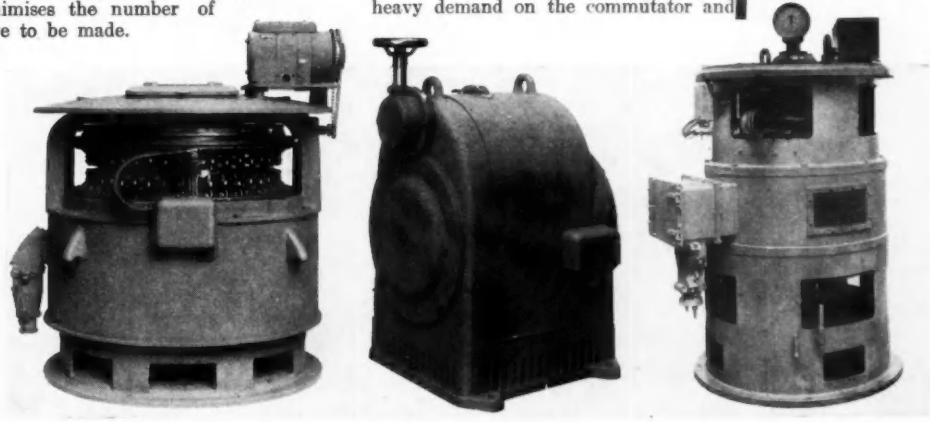
The shunt characteristics of commutator motors, the constant and uniform acceleration under any printing condition without the least suspicion of snatching, and the fact that the consumption of power is proportional to the work done render them ideal for driving printing presses. For feeding in the paper, and inching the cylinders a small auxiliary barring motor is used; for speeds above this, the main motor takes over the duty. The equipments are arranged for simple push-button control without resistances.

Tests made on two similar presses in a printing office, one driven by an a.c. commutator motor and the other by a resistance-controlled induction motor, proved that a saving of 25 per cent. in time and 50 per cent. in running costs was gained with the former equipment.

A useful application is for fans where the motor is always running, but for certain periods the output, and therefore the speed, is considerably reduced. Since the speed control of the motor does not entail any external loss, the cost for power is reduced to a minimum.

High-speed lifts have come into common use with the recent development of large buildings, and this is one of the most arduous duties which a motor is called upon to perform. The motor is required to give a high starting torque, and maintain a high rate of acceleration and retardation, the latter by regenerative braking. It is for lift speeds of over 200 ft. per min. that this type of drive is particularly applicable, and at these speeds the time allowed for acceleration is very short, amounting to a few seconds only. During frequent operation of the lift the almost continuous speed variation makes a heavy demand on the commutator and brushgear and this demand is met without undue sparking or trouble of any kind.

A large wheel lathe has a constant h.p. rating over part of the speed range and a constant torque over the remainder;



Three examples of vertical shunt commutator motors

From left to right: A three-phase 80 kW, 580/430 r.p.m. 500 V machine with automatic speed regulation by float switch (Brown Boveri); a drip-proof motor 1,250/600 r.p.m. (Brown Boveri); and a drip-proof machine (150/110 h.p., 1,050/830 r.p.m. 400 V) for a borehole pump drive (B.T.H.)

by adjusting the speed, various sized wheels can be machined. The brushgear of the motor is electrically operated by push-button control, so that the speed can be immediately reduced if hard spots on the wheel are encountered.

The frequence-changer method of speed regulation is employed when it is required to vary the speed of a large number of motors and to keep them all at the same speed. Thus, for sectional drives of big machines or of several combined machines working on a continuous band of stuff, automatic speed equalisation can be easily arranged for by making use of an alternator driven by a variable-speed commutator motor. Such an arrangement is used in an artificial-silk spinning mill to supply current to a number of small squirrel-cage motors driving spinning spindles.

The Battle of the Systems. By F. J. Phillips

AT the ordinary meeting of the Institution of Electrical Engineers last evening Messrs. R. Grierson and D. Betts read a paper containing a " critical examination of the present practice relating to the electrical warming and air-conditioning of, and the supply of hot water to, the larger buildings." We are told that " there is greater joy in Heaven over one sinner that repenteth than over ninety and nine just persons who need no repentance." If this be so what pæans of prise must have arisen from that small but select body of the electrical hierarchy who support the use of off-peak current at economic prices upon reading the paper by Messrs. Grierson & Betts! When considering the views expressed by these authors and comparing them with the diametrically opposed opinions propounded by one of them so recently as the spring of 1931, one is compelled to inquire, " What can be the cause of this volte-face? "

Mr. F. J. Phillips is with Messrs. Sulzer Bros. (London), Ltd.

In Mr. Grierson's first paper entitled " The Electrical Heating of Buildings " there were forty-eight pages of printed matter, of which five only were devoted to thermal storage, while in the description of systems one page only was given to this subject—and this in the year 1931. In the 1934 paper there are forty-six pages of matter and of these—so important has thermal storage become in the eyes of the authors—no fewer than twenty-three are devoted to this method. In the description of systems we find now twenty-three pages upon this subject and two only upon direct heating.

During the three years which have elapsed between the reading of the first paper and the writing of the second no new development has occurred in the field of thermal storage, except that in a few districts a reduction in the rates of off-peak current has been obtained, mainly owing to the pressure of those who had pioneered this system from the beginning. The technical features are the same to-day as they were in 1925 when the first of these plants was installed in this country under my supervision.

In the paper of 1931 Mr. Grierson stated that " thermal storage systems, when superficially examined, are apparently very attractive, but what are the actual facts? Little support of the system is seen here." Again, the author said " . . . . when all these items have been considered and allowed for the fact remains that unless automatic temperature control is provided for each room . . . clearly off-peak rates must be substantially lower than those offered for low-temperature thermostatically controlled direct-heating systems."

It will be seen from the above two statements how faint was the praise with which the author damned thermal storage in 1931, and how little was his belief in the system. It cannot be claimed that thermal storage was in its infancy in 1931, as even at that date the firm with which I am associated had not less than 200,000 kW of connected load in Europe, while in Great Britain eight large installations were in commission.

The earlier paper purported to give information and advice upon the choice of electrical systems and a critical survey of the possibilities of electric heating. To many it appeared to indicate that the use of low-temperature electric panels was the only economically sound method of employing electricity for large space heating. The claims of thermal storage were almost completely ignored and in the view of the author only redeemed from complete failure by the employment of individual room controls.

Where are the large direct electrically heated buildings to support the claim in face of the large number of thermal storage plants of 1,000 kW and upwards? There has been ample opportunity since 1931 for the development of the principle advocated by the author of the paper, but the actual facts are that, whereas thermal storage methods have rapidly advanced, direct methods have declined, at least so far as large installations are concerned. Further, in view of the author's expressed opinion that thermal storage was only justified if automatic control of individual rooms was provided, it would be interesting to learn where such plants of large size are to be found. It is known that the principle has been tried—and found wanting!

The paper of 1934 could have been written in 1931 and the conclusions stated with equal truth. It would appear that the actual facts have been forced upon his notice by stress of competition and the success of the many installations of thermal storage. The most suitable type of plant for any specific purpose will inevitably force itself into the front rank. The direct method, so enthusiastically advocated in 1931, is practically ignored in 1934 and pride of place is given to thermal storage, which in 1931 received no support.

It is true that the paper of 1934 offers no recommendations. Is this because even now thermal storage does not meet with the author's complete approval? Or is it that, having been converted against his will, he is unwilling to make public confession of faith?

There are many statements in the 1934 paper which cannot be allowed to pass unchallenged. As an instance, the basic comparison of electricity with coke-fired boilers is given as 0.1d. per kWh and it is suggested that only the amenities of electricity will justify a higher rate. This is definitely inaccurate, and unless corrected will certainly retard the employment of electricity for large space heating in which field thermal storage is the only system which can possibly justify itself on economic grounds. The actual figure depends very largely upon the period of occupation of the building.

If for continuous heating the rate is approximately	0.125d.
If for 7 days per week and 18 hours per day.....	0.133d.
If for 5½ days per week and 9 hours per day.....	0.175d.
If for 5 days per week and 8 hours per day.....	0.19d.

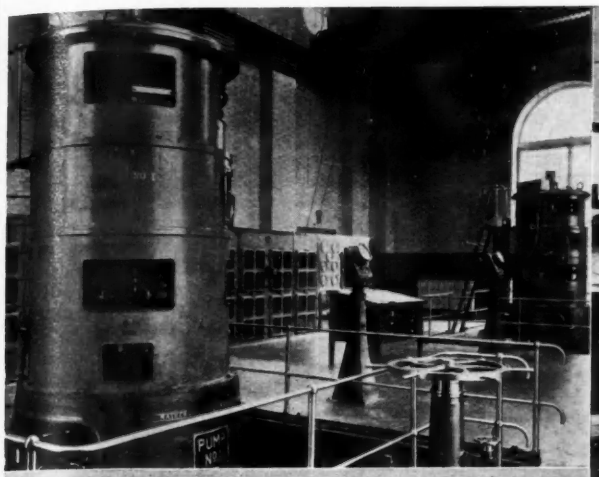
The above figures are based upon coke at 35s. per ton with no allowance whatever for labour. The days and hours represent normal use in hospitals, residences, offices and schools respectively. In arriving at the size of boiler required for thermal storage plants, Mr. Grierson seems to assume that they will be continuously in commission night and day at full load, a condition which applies exclusively to use in hospitals. The result is that the connected load will be much smaller usually than the author maintains. For instance, a statement is made that in the case of a direct electrically heated building of 400 kW demand, if switched off at night, the load will require to be increased to 460 kW to permit of rapid heating in the morning, and that a thermal storage boiler load to correspond would be 750 kW with panel heating and 1,000 kW with radiators. Actually, as no night heating is required, the boiler loads would be 500 and 600 kW respectively.

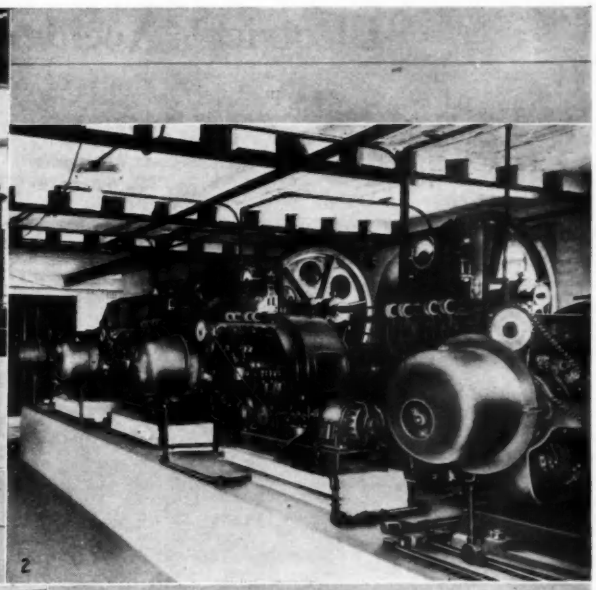
In the later paper claims are still made for the use of magnetic valves in thermal storage plants, but practice has shown that in a correctly designed system central " variostat " control is at least equal and certainly considerably less expensive than the method advocated by the author.

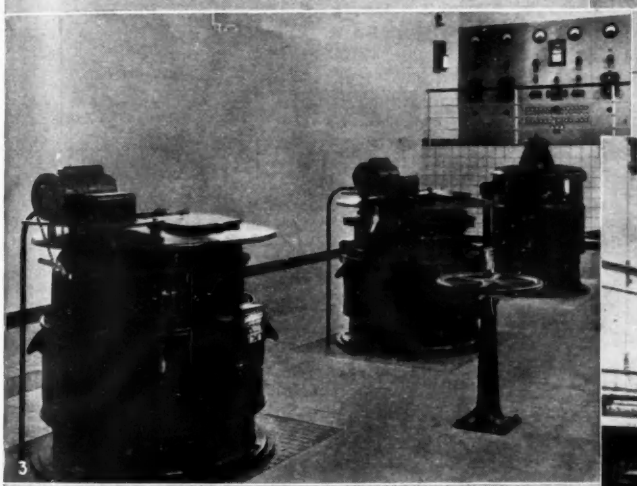
It would appear that Mr. Grierson is unaware of the numerous thermal storage plants in which the electrode system is actually built into the storage vessel, and in which there are no circulation troubles. He also appears to miss the point that the useful range of temperature through which a thermal storage plant operates is the maximum storage temperature minus the return temperature from the heating system.

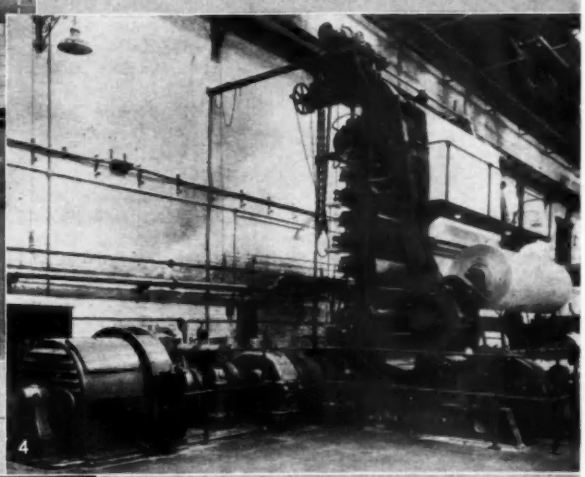
Mr. Grierson, when dealing with the subject of venting thermal storage vessels, is certainly entering upon very debatable grounds. There is a large number of plants in operation in which the superheated water is vented from the top of the vessels, expansion taking place from the top with none of the evil consequences which he predicts.

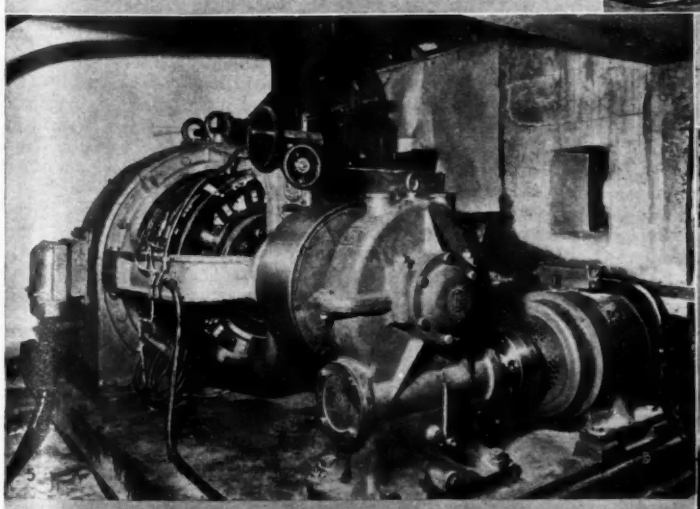
There can be no question that the design and installation of a perfect thermal-storage plant calls for not only considerable skill but also much practical experience. This cannot be obtained from text books and very little information of a useful character has been published. It seems that safe practice would be to consult those who have had the necessary experience and who, by trial and even by error, have succeeded in overcoming the difficulties and troubles which are inherent in the system and are unknown to the outsider.

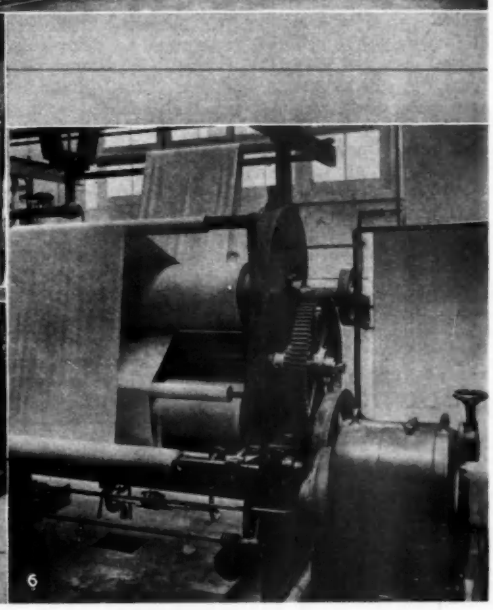












Applications of A.C. Commutator Motors for Variable-speed Drives. **(See page 779.)**

1. In a borehole pumping station (420/250 h.p., 810/645 r.p.m. drip-proof machines). 2. For operating high-speed passenger lifts (32/6 h.p., 1,050/360 r.p.m.). 3. A pump drive with automatic float control. 4. A super-calender in a paper mill (250/83 h.p., 540/180 r.p.m.). 5. An equipment (one of five) for driving a rotary newspaper press (80/22 h.p., 750/210 r.p.m. with 12-h.p. barring motor). 6. A wringer drive. (The machines in figs. 1, 2, 4 and 5 are by the B.T.H. Co. and in the other two by Brown, Boveri & Co.)

Electrical Accidents. By J. B. Harris

A study of recent statistics

THE total number of fatal accidents due to electricity that occurred between 1922 and 1931 was 237, which is nearly the same as that for the previous ten years. The total number of accidents reached a maximum in 1924, due probably to an increase in the use of electrical apparatus. The decided decrease in subsequent years (the total accidents in 1932 numbering 313, of which nineteen were fatal) is mainly due to the more general adoption of protective devices and other precautionary measures.

Most accidents are found to occur in connection with outdoor switchgear due to cleaning, &c., being carried on while the switchboards remain alive in the interests of continuous service.

The following fatalities occurred in 1931 and 1932 with a.c. at various voltages:—

Voltage.	Fatalities.	
	1932.	1931.
Above 10,000	6	2
5,000 to 10,000	3	0
650 to 5,000	2	2
250 to 650	3	7
Below 250...	5	10

One death occurred in 1931 on d.c. at 460 V. Thus, lower voltages account for as many deaths as high, and a number of shocks at the higher voltages do not prove fatal. During 1931 there were six cases of non-fatal shock above 1,500 V, and three cases above 6,000 V. The explanation is that the duration of the shock and the total resistance are the decisive factors.

In the four years from 1922 to 1925, the number of accidents at low voltages was 1,027—688 on d.c. and 399 on a.c. Of these three proved fatal on d.c. and fifty-two on a.c.

Accidents in electrical work are attributed to the electrical force or to chemical or calorific effects; often the part played by the "shock" is greater than that due to electricity itself. Electricity spreads itself in the body internally and superficially and stimulates the nervous system violently, resulting in inhibition of the vital centres of the brain, just as a sudden blow over the solar plexus may produce sudden death by reflex stopping of the heart and respiration. Factors affecting shock are as follows:—

The more unexpected the shock, the more violent is the effect. Thus people have been struck by lightning and although injured have remained conscious, because they had expected the flash.

High and Low Voltages

Accidents are quite as likely to occur on fairly low as on high voltages, and the non-realisation of this is the cause of many fatalities. Much depends on the general state of health of the person concerned. Death has followed a shock at as low a voltage as 38 in Budapest. Fitzsimons reports a case in which a man at a colliery was subjected to 20,000 V. After twenty minutes' artificial respiration he recovered, the only injury sustained being the sloughing of a large piece of flesh from the sole of one of his feet. Thus, on the whole it is unwise to distinguish between high and low voltages. From statistics of accidents occurring in various countries, it appears that low voltage fatalities are most numerous in the Netherlands, and high voltage fatalities in Switzerland. In regard to current, there have been cases where the victim has received more than one ampere, and has retained consciousness, while on the other hand people have been materially affected by currents of a few milliamps. As a rough approximation, currents under 25 mA are considered fairly harmless, 25 to 50 mA cause injury, while 100 mA may prove fatal.

Fatalities occurring with fairly low voltages are usually due to the making of good contact, such as standing in water, when 100 V may cause death. The larger the surface of contact, the more serious is the injury likely to be. The moisture of the skin increases the conductivity, so that there is greater likelihood of accidents in hot spells than in cold weather. With fairly high voltages contact with the conductor need not be made, since the current will jump across a short gap to the victim. What is termed "flash" occurs and this is liable to cause destruction of large areas of skin. Also the longer the time of contact the greater are the injuries received.

Resistance of the skin varies considerably with different individuals and with moisture. Average figures are from 8,000 to 40,000 ohms. According to Jeliffe, when the skin is damp, the resistance may be as low as 500 ohms.

The Type of Current

With regard to the type of current one medical man writes, "there is nothing to show that a.c. is more dangerous than d.c., though such is commonly supposed to be the case." Other authorities have made statements to the contrary.

The particulars given over a four-year period of low-voltage accidents referred to above, also show the percentage of fatalities on d.c. was 0.029, compared with 0.13 on a.c., which gives a ratio for a.c. to d.c. of 4.5 to 1. The two main reasons why a.c. appears to be more dangerous than d.c. of a similar voltage are that the a.c. peak voltage is about 41 per cent. greater than the r.m.s. value and the effect of frequency is an alternate contraction and relaxation of the voluntary muscles, increasing the work done by them. From this it might at first be assumed that the higher the frequency the larger is the number of muscular contractions per second and the sooner fatigue is produced. Thus, a frequency of 50 cycles per sec. will soon produce in the muscle a state of continuous contraction or tetanus. The limit of frequency is reached at about one million cycles when the current reversals are so rapid that the muscle no longer contracts when stimulated; this is made use of therapeutically.

Mr. J. B. Harris is a student member of the Institutions of Civil & Electrical Engineers

Curious Accidents

Some curious accidents have occurred, *e.g.*, a builder came into contact with an arc lamp which happened to be alive. Attempts to revive him at first appeared to be successful. Suddenly, however, he died, and autopsy revealed that he had been suffocated by vomiting due to too vigorous attempts at artificial respiration. There have been many similar cases in which death was not directly due to electric shock, but to efforts at resuscitation.

Artificial respiration is equally good for both high and low voltages and if carried out correctly, the chances of saving life are the same for both. The rescue of the victim may be impeded by two factors, namely, shutting off the current in a hesitating manner and thus increasing suffering; and failure to start artificial respiration soon enough or to maintain it for a sufficient length of time; an engineer who received a 35,000-V shock recovered after three hours of this treatment.

Effects of Shock

The injuries produced by electric currents may be local, distant, or general. As Oliver states, a person may be burnt, rendered unconscious, or killed instantly. There are three main theories explaining how death may be brought about: (i) Nervous inhibition causing the arrest of either the respiration or the heart. (ii) Immediate cardiac paralysis, resulting in fibrillary contraction of the heart from low voltages, due to direct action of the current on the muscle, producing a condition resembling tetanus in voluntary muscle; with high voltages there is complete nervous incoordination. (iii) Hæmorrhage and cytolysis.

Jellinek adopts the first theory and considers that a counter shock may reverse the effect of the first shock. Scott has stated that recoveries are more frequent if, after the current has been switched off, the victim is released from a height. Prevost and Batteli adopt the second theory, basing their conclusions on the results of animal experiments.

The effects of the shock in the body produce arrest of the vital functions, such as may occur from other exciting factors; *e.g.*, detonation of an explosion, or a cold douche. In a similar manner the electric current may produce catastrophic results by reflex stimulation of the nerves of the vital organs setting up sudden changes. These effects may disappear, either spontaneously, or after treatment by artificial respiration which should be continued for an extended period.

The external lesions are so characteristic that they may be regarded as pathognomonic. The traces of the current are very clear in form (circular, arborescent). The epidermis which remains is often greyish and fairly hard; there is no surrounding redness and pain is absent and there may be nothing to suggest a burn. The lesion may be sufficiently severe to attack the bones and in healing may leave such signs as suggest that the lesion has been a burn. To a great extent the skin lesions are localised and the prognosis is generally very favourable.

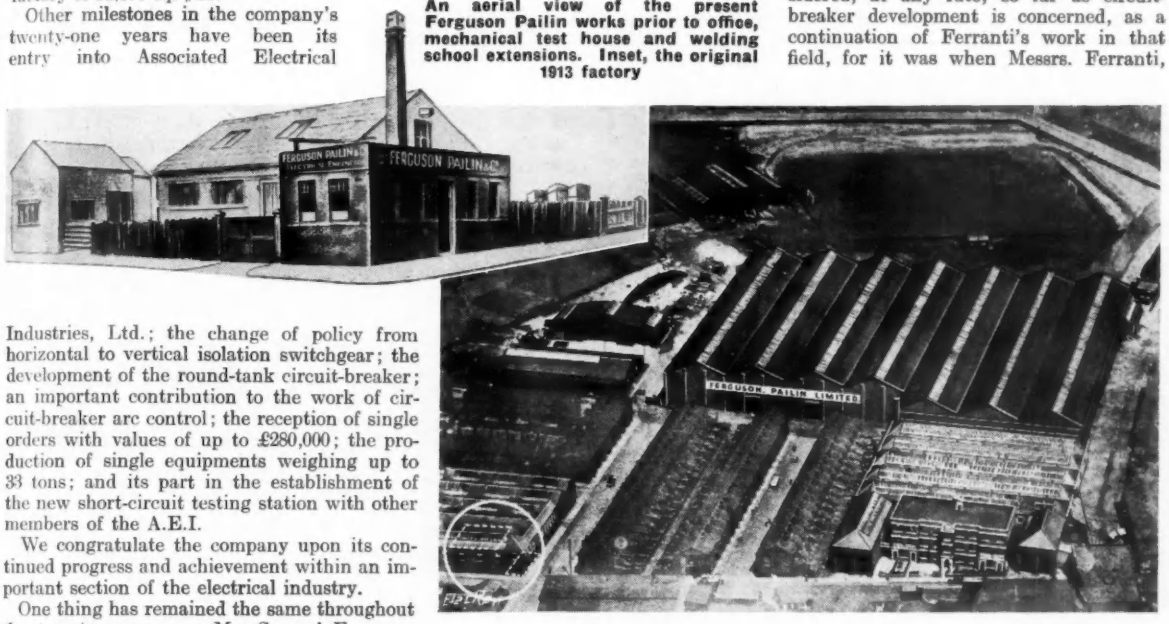
Ferguson, Pailin's Coming-of-Age

THIS week has seen the celebration by Messrs. Ferguson, Pailin, Ltd., of their twenty-first birthday. Looking back upon its minority the company can find much for gratification, and the rest of the electrical industry will agree that its history is an interesting one.

The company commenced with a capital of £1,000; the figure is now £600,000. At first there were two employés, and the factory had a floor area of 189 sq. yds. There are now something like 1,500 employés and the floor area of the present factory is 31,000 sq. yds.

Other milestones in the company's twenty-one years have been its entry into Associated Electrical Industries, Ltd.; the change of policy from horizontal to vertical isolation switchgear; the development of the round-tank circuit-breaker; an important contribution to the work of circuit-breaker arc control; the reception of single orders with values of up to £280,000; the production of single equipments weighing up to 33 tons; and its part in the establishment of the new short-circuit testing station with other members of the A.E.I.

We congratulate the company upon its continued progress and achievement within an important section of the electrical industry.



An aerial view of the present Ferguson Pailin works prior to office, mechanical test house and welding school extensions. Inset, the original 1913 factory

One thing has remained the same throughout the twenty-one years: Mr. Samuel Ferguson and Mr. George Pailin, who were the active members of the partnership of six which was formed in December, 1913, are still to-day the working directorate to whom the direct control of the business is left. The other members of the board are Sir Felix J. C. Pole, Mr. William C. Lusk, Mr. Francis Fraser, and Mr. Joseph Wilson.

Between the initial partnership and the formation of the A.E.I. three or four years ago, the following are outstanding events in the control of the organisation. It was registered as a private limited company with a nominal capital of £10,000 only a few years after its birth, and in 1918 it became a public company. A few years later a public issue was floated and the capital was increased to £200,000, and in 1926 a controlling interest in the company was acquired by the British Thomson-Houston Co., Ltd.

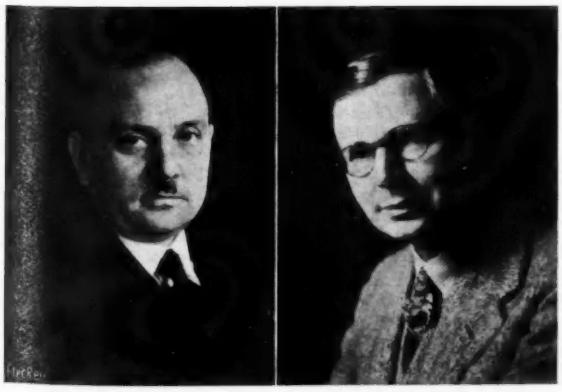
In a foreword to a particularly attractive "coming of age" souvenir, Mr. Ferguson says "our greatest joy is the knowledge that we have been able to give such continuous employment to an ever-increasing number of employés." The company has benefited by its close association with the Manchester University and College of Technology, from which many graduates have been drawn who have ultimately filled important administrative positions. Such names as those of Messrs. W. T. Tallent-Bateman, F. Clegg, J. R. Wilkinson, W. H. Miller, H. Boardman, J. W. Hammond, E. M. Dakin, A. J. Nicholas, S. Farrer, W. P. Dempster, R. A. Rowbottom, A. J. Bailey, and J. Ashworth are included among those of the present-day staff, and are familiar to many within the industry.

The original factory in Edward Street, Higher Openshaw, Manchester, consisted of a small one-storey building and an adjoining wooden shop. The first section of the new factory was erected in 1919 about 100 yds. from the Edward Street site. The company's development to its present position as one of the world's largest switchgear manufacturers may be considered, at any rate, so far as circuit-breaker development is concerned, as a continuation of Ferranti's work in that field, for it was when Messrs. Ferranti, Ltd., decided to discontinue the manufacture of switchboards that Ferguson, Pailin came into existence, and the partners of the new company had been in the employ of the older one.

Within six months of the receipt of the first order for vertically isolated metal-clad switchgear the company had changed its policy from horizontal to vertical isolation and developed the first double-circuit breaker unit for bus-bar selection.

With a few exceptions the round-tank breaker has superseded the rectangular design, and this construction is now incorporated in even high-rupturing capacity low-pressure equipments. Research into the various methods of controlling arcs under oil led to the adoption of the oil-blast type in the form of a cross-jet explosion pot.

Short-circuit testing is now an accepted part of normal development and proving of the company's products, and ample facilities are available for carrying out this important phase of manufacture and research at the new short-circuit testing station at Trafford Park, Manchester, operated by the Switchgear Testing Co., Ltd., which is partially controlled by Ferguson, Pailin. The factory is equipped with two testing laboratories—one where pressures up to 500,000V can be applied under varying conditions of humidity, etc., and also the mechanical test house, where static and impulse hydraulic tests can be applied to oil circuit-breaker structures.



Mr. George Pailin and Mr. Samuel Ferguson, the original active partners and present working directors

A Celebration Dinner

There were over 250 guests, including representatives of supply authorities, associated concerns, employés and customers at a celebration dinner held at the Midland Hotel, Manchester, on Monday night. Speaking of the policy of the company, Mr. S. Ferguson, director, said he was firmly convinced that the secret of successful management was to establish equity between the proprietors, employés and customers. He went on to pay a tribute to Messrs. Ferranti, Ltd., and to all who had assisted to make Ferguson, Pailin, Ltd., a power and an influence in the industry. He recalled that in its first year it handled orders 12½ times the amount of its capital. Mr. Robert Blackmore, manager of the North-Western Area, C.E.B., he said, had played an important part by placing with the company its first order.

Mr. Blackmore, who later was presented with an autographed memento, proposed the toast of "The Company."

Sir Felix J. C. Pole, chairman of Associated Electrical Industries, Ltd., who supported the toast, described Ferguson, Pailin as one of the leading concerns in the industry, participating, with its associated companies, in the widest possible outlook and experience in electrical affairs.

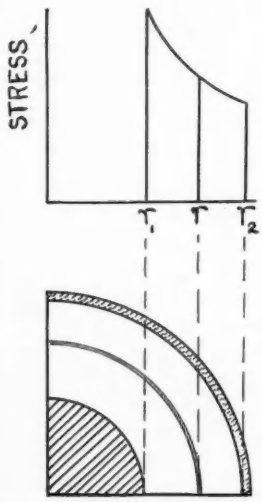
Other speeches were made by Messrs. A. J. Nicholas and J. R. Wilkinson, and Capt. J. M. Donaldson.

Electric Stress in Cable Insulation

By G. W. Stubbings, B.Sc., A.M.I.E.E.

AN insulating material is defined as one which offers a relatively high resistance to the passage of an electric current. The difference with regard to resistivity between insulating materials and conductors is not merely one of degree; the resistance of a conductor does not vary as the voltage applied to it is increased, except in so far as the current flowing in it causes an increase in temperature, and, could the temperature of a conductor be kept constant by cooling, its resistance would, no doubt, be independent of the voltage applied to it.

The resistance of an insulating material does not show this constancy, as there appears to be a critical value of the applied voltage above which the resistance becomes suddenly very small, and the insulating material is said to break down. The precise cause of this breakdown is not known, but experience has shown that the ability of an insulating material to offer a considerable resistance to the passage of a current depends upon the applied voltage and upon the distance between the points of application.



The variation of electric stress in cable insulation

The similarity between the loss of insulating properties and fracture under mechanical stress has suggested that the application of a voltage to an insulator gives rise to a condition of what is called electric stress; as mechanical stress is measured in force per unit area, it appears reasonable to measure electric stress in volts per unit distance and to assume that breakdown will occur at a stress that will be a characteristic of the material.

Experiment shows that this conception is incorrect, as doubling the thickness of a sheet of insulating material does not double the value of the breakdown voltage. This does not necessarily disprove the correctness of the basic hypothesis, as the effective distance between the points of application of the voltage may not be quite proportional to the thickness of the material, but it indicates that the quantity, electric stress, may be difficult to evaluate. In spite of the non-confirmatory results of experiment, it is felt to be impossible to conceive upon what circumstance, other than stress in volts per unit distance, the breakdown of an insulating material can depend.

The difficulty in estimating the effective distance between the electrodes at which the voltage is applied to an insulating mechanism arises when attempting to evaluate the stress in the insulation of a single-core lead-sheathed cable. Since the path of the leakage currents in such a cable are radial if the insulation is homogenous, it might appear that the stress in the material could be obtained by dividing the voltage on the core by this radial thickness of insulation. This is not the case, for the stress varies throughout the thickness.

Variation of the Stress

Let us suppose that the leakage current flowing from the core to the sheath of a cable, with the voltage applied, is I per unit length of the cable, a quarter section of which is shown in the figure. Consider a thin annular layer of the insulation, the thickness of which is small, say, 0.1 mm. and let this thickness be t, and the average radius of the layer be r. The path of the leakage current will be radially through this layer. The cross section of the layer with respect to this current, for unit length of the cable, will be numerically equal to its average circumference, that is to $2\pi r$; the length of the layer in the direction of the current will be constant and equal to t. The resistance of the layer is thus $\rho t/\pi r$, where ρ is the resistivity of the material. The voltage drop across the layer in a radial direction will be I $\rho t/2\pi r$. The stress, in volts per unit length, is thus I $\rho/2\pi r$ and it varies inversely as the radius of the layer.

The graph shows that the stress is greatest next to the conductor, and diminishes towards the sheath. Further, the difference between the stress next to the conductor and that next to the sheath depends upon the ratio of the internal and the external diameters of the insulation. Calculation shows that, with a given external diameter and applied voltage, the stress next to the conductor increases without limit as the diameter of the conductor is diminished. There are thus two conditions in which, with a given voltage and external diameter of the insulation, the stress can be very large; the one when the thickness of the insulation is vanishingly small, and the other in which the diameter of the conductor is reduced without limit.

It follows that, with the outer diameter of the insulation and the voltage fixed, there is a definite ratio of the outer to the inner diameter of the insulation which gives the minimum stress next to the conductor. This critical ratio is e, the base of natural logarithms, and is equal to 2.72. The latter considerations are, perhaps, rather of theoretical interest than of practical importance; the principal point is that the electric stress is not constant in a single-core cable, being greatest next to the conductor.

Capacitance Effects

The above results have been obtained by considering the voltage drop across layers of the insulation due to the passage of the leakage current. When the conductor of a cable is subjected to an alternating pressure the pseudo current in the insulation, due to capacitance, is very much greater than the actual current through the insulation due to leakage. The results obtained when considering this leakage current depend upon the geometrical fact that the conductance of a layer of insulation is proportional to its average circumference, and inversely proportional to its thickness. The admittance of a condenser regulates the flow of capacity current in exactly the same way as conductance regulates that of leakage current. The capacitance of a cylindrical condenser depends upon its dimensions in the same manner as the conductance of a layer of insulation of a cable. It follows that the electric stress in the insulation of a single-core cable due to the passage of capacity currents is exactly the same in its distribution as that due to leakage currents.

While the thickness of the insulation of a single-core cable is small with respect to the conductor radius, the variation in the electric stress in the insulation is not very important. Nor is this variation of any great moment with low-voltage cables in which the factor of safety of the insulation is high. The difficulty arising from the variation in the stress became of importance when the design of cables for very high voltages was first attempted. If the thickness of the insulation is equal to the radius of the conductor, the results deduced above show that the stress next the conductor is twice that next the sheath. If the insulation is so designed that the stress near the conductor is kept to a safe figure, then the outer layers of insulation are used inefficiently. If, on the other hand, the outer layers of insulation are stressed to a normal amount, those near the conductor will be overstressed.

Methods of Equalising Stress

Of the many methods devised to equalise the stress in the insulation without introducing complications or other sources of weakness, the simplest, from the point of view of cable construction, consisted in the insertion between the core and the sheath of a conducting inter-sheath, the potential of which was artificially retained at a figure that made the stress next to the conductor equal to that next to the sheath, for which purpose a current would have to flow into the intersheath. The attendant complications prevented this system from coming into commercial use.

Another method of equalising the stress was by the use of materials with varying permittivities. If the permittivity of the inner layer of the insulation is greater than that of the outers layers, then the capacitance of the inner layers will be increased, and the voltage drop over these layers due to the flow of the capacity current will be reduced. A cable constructed on these lines was shown as far back as 1906. The permittivities of the four different materials used varied from 6.1 in the inner layer to 4.0 in the outer layers. Cables of this type did not come into commercial use owing to the difficulties arising from the different physical properties of the materials.

The most modern method of dealing with variable stress in cable is to use papers of varying electric strength. A dense non-permeable paper has a considerably higher electric strength than one which is relatively porous, but some porosity is essential for efficient impregnation with oil or compound. By using paper of low permeability and high electric strength next to the conductor and paper of high porosity and low strength near the sheath, a suitable value for the average porosity can be retained, while the factor of safety is kept up in the region of the maximum electric stress.

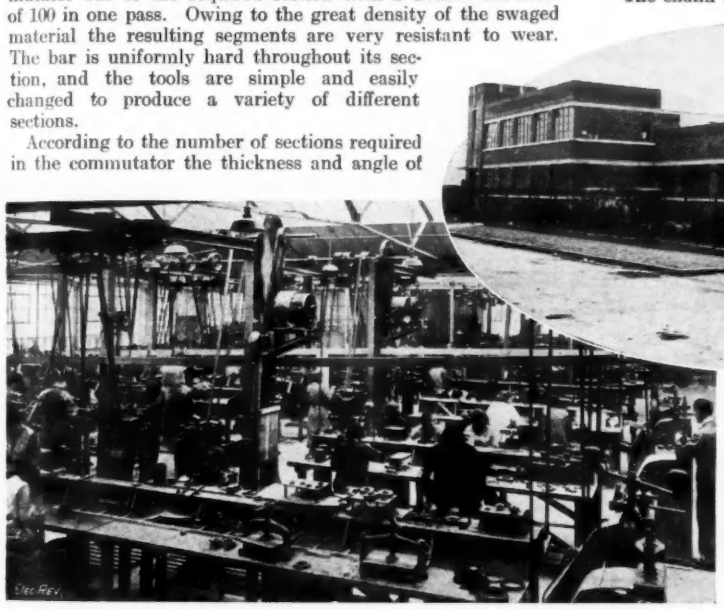
Developments in Commutator Production

A survey of the manufacturing processes at a large new factory near London

MORE commutator motors are being made in this country to-day than ever before, and the number imported from the Continent is rapidly decreasing. A good deal of the credit for this satisfactory state of affairs is due to Messrs. Watliff Co., Ltd., who have recently established at Morden an up-to-date factory designed to handle large contracts for motor manufacturers whose production is dependent upon regular and reliable supplies of commutators. The following is a brief outline of the processes involved in the production of commutators which we recently inspected.

A special method has been developed for producing the V-shaped copper bar required for commutator segments. The copper is swaged to the required section between specially shaped reciprocating tools, the strip being intermittently fed past the tools, and in this way it is possible to produce commutator bar of the required section with a Brinell hardness of 100 in one pass. Owing to the great density of the swaged material the resulting segments are very resistant to wear. The bar is uniformly hard throughout its section, and the tools are simple and easily changed to produce a variety of different sections.

According to the number of sections required in the commutator the thickness and angle of the "V" varies so that the correct diameter results when it is assembled. The V-shaped bar is then blanked in power presses into suitable lengths or shapes for the actual commutator segments, the correct number of blanks being assembled in a circle and lightly held together by a rubber ring. Checking for the correct number of segments is usually effected by weight.



The Watliff commutator works, and a view of some of the commutator building machinery

The bundle of segments is then ready for the insertion of soft quality amber mica separators. These are cut to size or shape by blanking in dies held in a hand press, and each piece of mica is gauged by micrometer to the required thickness before insertion between the segments. It is important that the proper grade of mica shall be used, as there are many different qualities, some of which are poor insulators. Where the commutators are to be run with flush micas the degree of hardness of the mica is also important; if too hard "high micas" will result after a short time of running.

After being clamped within a split tool the assembly of segments and separators is forced hydraulically into a hardened steel ring, thus forming a very tightly compressed unit. On high-speed lathes of special design conical recesses are turned in each end of the segments, and these recesses are so shaped as to accommodate the steel centre piece and mica insulation which will eventually hold the whole assembly together. In some cases these recesses are formed by blanking the copper segments to the required shape before assembly, thus dispensing with the turning operations, and when this is done the assemblies are ready for the centre bushes immediately after being compressed in rings.

The assemblies being now ready for the bushes and insulation to be inserted, it is important to scrutinise them carefully for any particles of copper bridging over the micas from segment to segment. No electrical test is possible between segments at this stage owing to the compression ring shorting all together, so that the expert eye and hand of the skilled operator is relied upon to clear all "shorts" between segments, and it is very seldom that internal trouble from this operation is found when the commutators are finished.

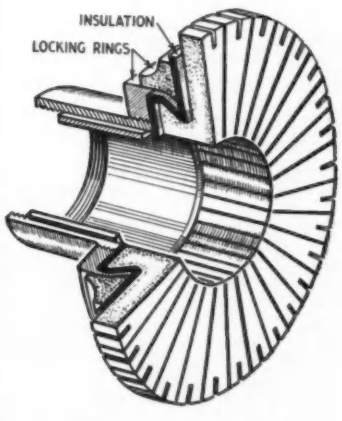
A steel centre bush which is next inserted into the recesses in the segments, with the necessary insulation between it and the assembly, has a conical head which fits exactly the conical recess in the segments, and is also provided with a similar conical ring which fits tightly over its shank and into the recess formed at the other side of the segments.

Insulation of pure mica specially shaped, or of micanite built up from mica splittings, is placed in the recesses at the time the bush and ring are inserted, and a sleeve of micanite is placed in the bore of the segments to protect the shank of the bush. The thickness and disposition of this insulating material is important, as on it depends the ability of the finished commutator to pass its high-voltage flash test. The design of the conical recesses and the proportions of the steel bushes and rings and the insulation used are all-important, as upon these depends the production of a really tight and sound commutator which will withstand high speeds and temperatures. Each type and size of commutator has to be treated on its own merits and specification for these features.

The shank of the steel bush now protrudes slightly through the conical ring, and this protruding end is flanged over the ring while the bush and ring are tightly pressed into the recesses in the segments, and the bush insulation is thus compressed. This is effected in specially designed compressed-air presses with pressures adjustable up to 12 tons.

Uniformity of pressure is essential to the success of this operation, and the reliability and uniformity of the commutators are largely due to the care taken in this operation and to the use of these special machines.

When the bush is assembled in the commutator an a.c. flash test at up to 4,000 V is applied between the bush and the compression ring. The commutator having successfully passed its test is pressed out of the compression ring, being completely held together by its bush. It is held on special quick-acting arbors and turned in high speed lathes to the finished dimensions required. After turning, wire slots to receive the coil ends are cut in the segments by small high-speed cutters which leave a clean and accurate slot, and the commutator is now finished except for its final inspection and electrical tests.



Construction of a special face commutator

In view of the complexity of the operations needed to produce a commutator (at least 23 being involved in each case) the whole productive organisation involves many special problems to regularly maintain its designed output of 1,000 commutators of all sizes per day.

Apart from standard commutators, we saw examples of the special constructions which have been catered for, and some of these are becoming popular. For instance, face or radial commutators are used for extra high speeds and they can be made without shrink rings (as was common for the high-speed turbo exciter commutators), the equivalent of the shrink rings being formed by the inserted ring construction, but with the added advantage that the rings are far more tightly clamped

on the segments than is feasible by shrinking. This construction can also be applied to extra long commutators such as are used for low-voltage heavy-current plating generators, and it is now possible to completely provide for the expansion due to temperature rise to take place without the slightest distortion of the commutator brush surface.

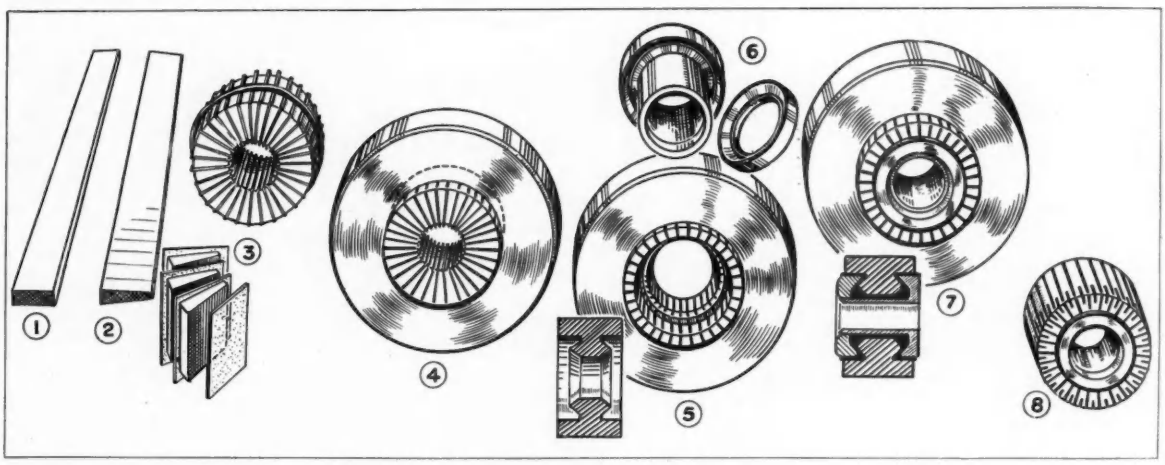
Standard slip rings are made of a special alloy bronze which has been proved to give the greatest freedom from the formation of flat spots, and they are sturdily mounted in a manner which makes it impossible for them to go out of the true. They are, moreover, insulated throughout with pure mica, which is claimed to be the best material known for permanence and high insulating properties.

The most usual way of building commutators in the past has been to clamp the segments between metal rings covered with micanite. This material consists of thin mica splittings pasted together with a bonding varnish of shellac, bakelite, or glyptal resin (usually 15 to 25 per cent. by weight), and if the assembly pressure is such that most of the bonding varnish is squeezed from between the pressure surfaces, a satisfactory commutator for normal duties will result. The bond remaining cannot in practice be reduced much below 10 per cent., however, and with a view to eliminating even this small residue methods of using pure mica without any bond at all have been developed. Pure mica insulated commutators may be heated to 550 deg. F., and the only detrimental effect of even higher temperatures is the annealing of the copper segments.

Mr. Hinchliff, a Watliff director, to whom we are indebted for help in compiling these notes, is doubtful whether, with the present moulding materials available, the application of bakelite moulding to commutators has been really successful. It has not been found possible, he said, to dispense with the pure mica separator between the segments, as any carbon base material would rapidly carbonise and short-circuit the segments at the least sign of sparking.

A commutator held together with moulded bakelite has to withstand some very severe stresses, which the mechanical and physical properties of bakelite are hardly able to deal with adequately over any length of time or under high temperature conditions. Another serious fault common to bakelite moulded commutators is due to surface tracking. The company feels that the advance made in the technique of mica-insulated commutators has made it unnecessary to continue the use of the moulded commutator, since the improvement has resulted in so cheapening the cost of soundly made and reliable mica-built equipment that the only advantage of the moulded commutator, namely, its cheapness, has now disappeared.

For commutators of under ¾ in. diameter there is, however, a field for the moulded type of construction, since here the stresses are so small that moulded bakelite is easily able to deal with them. The mica insulating of these types becomes a difficult operation, and the cost of production is considerably higher than for moulding.



Stages in the construction of a standard commutator

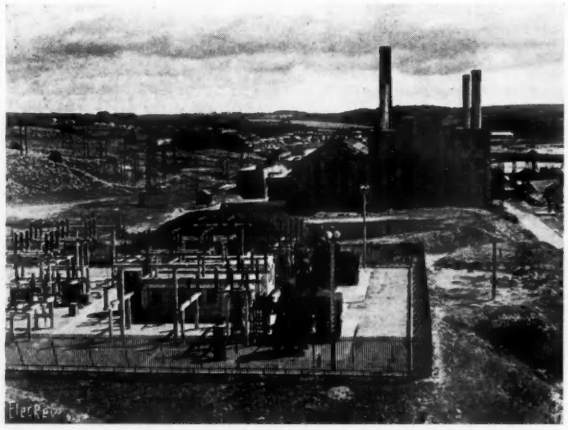
1. Rectangular section copper strip. 2. Swaged strip. 3. Rough assembly of segments and separators. 4. Assembly pressed from the temporary clamp into the hardened steel ring. 5. Conical recesses turned out on both sides. 6. The steel bush and ring of conical shape to correspond with the recesses in the copper. 7. Steel bush flanged over with insulation in place. 8. The completed commutator.

The South-Western Grid Tariff

THE Central Electricity Board announced last week end that it had adopted the South-West England and South Wales (Alteration and Extension) Scheme, 1934, to which reference was made on page 568 of our October 26th issue.

As originally planned seven generating stations were to be "selected" and two new ones were contemplated. The revised scheme provides for the "selection" of a further seven existing stations, bringing the total number in the area up to sixteen. The building of the new Tir John station at Swansea is being proceeded with, but the construction of the proposed station on Southampton Water has meanwhile been postponed.

The conversion of plant of non-standard frequency has been practically completed in Cornwall and is progressing satisfactorily in South Wales. The change-over involves about 140,000 h.p. of motors and over 100,000 kW of generating plant.



The Cornwall Electric Power Co.'s station at Hayle, which is being taken over by the Central Electricity Board on January 1st.

Slightly Higher Charges

General trading under the grid tariff in South-West England and South Wales is to commence on January 1st, 1935. The service and fixed kW charges follow those already established for other comparable areas. Similarly there is no change in the variations allowed, except in the case of the rating variant, which is 2s. as compared with 1s. 10d. The reason for this slight increase is that the capital expenditure on the transmission lines per kW of plant installed has been relatively high, since this is the largest of the C.E.B. districts, being approximately 25 per cent. of the total area covered by the grid schemes. The same reason accounts for the running charge being 0.225d. per kWh supplied, against 0.221d., but there is no change in the variation allowed for fuel cost.

Finally this tariff contains no clause relative to "special" supplies, since it will be rendered superfluous by the Bill now before Parliament, which is expected to receive the Royal Assent by the New Year.

Two more tariffs remain to be framed. One, for South Scotland, should become operative about March, 1935, when the Galloway water-power scheme is ready. The other, for the North-East Coast, will not be introduced until frequency standardisation has been accomplished in about eighteen months' time.

MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

Space, Air, and Water Heating in Large Buildings

PRESENT practice relating to the electrical warming and air conditioning of, and the supply of hot water to, large buildings, is examined (critically the authors claim) in the paper by Messrs. R. Grierson and D. Betts which was read at the INSTITUTION OF ELECTRICAL ENGINEERS in London on December 6th.

An attempt is made to deal with the tactics rather than with the strategy of the subject on the supposition that the principles of electric space-, air-, and water-heating are accepted, given suitable conditions.

Even in cases in which such credits as the amenity values of labour, dust, dirt, &c., elimination and the ability to plan buildings without chimneys are insufficient to tip the scale in favour of electricity, the economy resulting from certain methods of application and control of electricity as a source of heat and the precautions that can be taken in the design and construction of buildings against wasteful loss of heat (the capital cost of which may not be justified when cheap fuel is used) would in many cases so reduce the heat requirements of the building, in comparison with a fuel-heated installation, as to equalise the total running costs of the two methods.

The importance of heat-insulating the structure is demonstrated, and the value of the thermal storage capacity of the building materials is pointed out. The effect of the various types of electrical warming systems on the distributing network and on the load factor, including intermittent *versus* continuous warming, are stated to be questions for the supply authorities to decide; they can frame their tariffs according to the type of load they desire to develop.

It is considered that the diversity of demand is the only possible basis on which to quote or to secure a low price per kWh, *i.e.*, of the order of 500 kWh per £1 for unrestricted supply or 1,000 kWh per £1 for restricted hour supply. "Fixed annual charge" long-term contracts are now being offered by gas as well as electricity suppliers.

The second part of the paper refers to the development of warming and temperature control equipment, but there are no fundamental changes to report.

The third part is a long one, dealing in detail with immersion and electrode heaters, the arrangement and rating of elements, classification of heaters, &c. Similarly, temperature, time, automatic, and electrical control gear and connections are discussed, followed by details relating to water-storage vessels and pipework, circulation, heat insulation, and mixing control.

The fourth section is concerned with domestic hot-water supply equipment, types and arrangement of plant, and includes tabulated quantitative data on the water and energy consumptions; reference is also made to the heat required for swimming pools.

Finally, the fifth part is a short one dealing with air-conditioning equipment and the quantities of air and heat required therefor.

Spaced-aerial Direction Finders

SOME of the principles underlying the design of spaced-aerial, or Adcock, direction finders are examined in the paper by Mr. R. H. Barfield which was read before the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on December 5th.

The analysis is concerned mainly with the determination of two important properties of the systems, namely, their performance under the influence of downcoming waves and their efficiency as receivers of wireless energy. These characteristics are reduced to quantitative form by introducing the two factors named respectively "standard-wave error" and "pick-up factor," and the various aerial-system modifications are studied with the object of showing how these factors may be predicted for any given system and how they vary with the dimensions, wavelength, and other characteristics, and also with the constants of the ground on which the aerials are erected. The four principal aerial systems dealt with are the "U" type, the elevated type, the coupled type, and the balanced type.

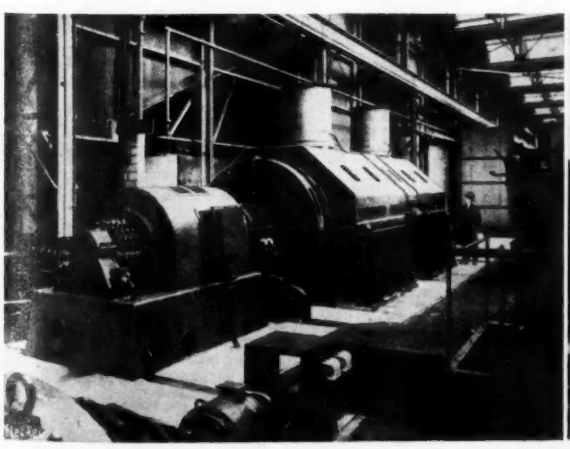
The "standard-wave error" of the type of direction-finders which is based on the principle of the closed loop or coil is first derived theoretically; it is found to be approximately 35 deg. for a large range of wavelengths, and to be independent of ground conductivity and dimensions of the loop within wide limits. Experimental confirmation of this is obtained on short waves (20 to 50 m.).

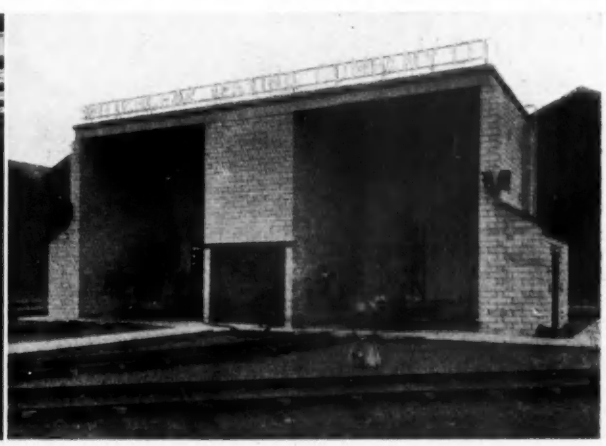
The theory of the "U" type is then considered and the method of calculating the standard-wave error for any given case is worked out. The agreement between values obtained in this way and the experimental results is satisfactory. The effect of screening the horizontal members of the system cannot be calculated by a quantitative formula. Turning to the elevated type, a working formula is obtained from calculating the standard wave-error. Based on tests by means of downcoming waves from a kite transmitter and also by a local injection method, a formula for calculating the performance of the coupled type of aerial is derived.

The balanced type is next considered, and a combination of the coupled and balanced systems was found to have a standard-wave error too low to be measured. Practical tables are given for each system, showing the standard-wave errors for various wavelengths, aerial-system dimensions, and soil conductivities, and also that the systems vary very greatly in performance with the conditions and with the details of their design. The paper concludes with a comparative table of standard-wave errors and pick-up factors for the various systems.

The conclusions are that the performance of any given system is vitally affected by a large number of factors, including height of aerials, conductivity of soil, height above ground of horizontal members, &c., and a study of tables in the paper is probably the best way of arriving at an accurate estimate of the relative merits of each system. A few general statements can, however, be made which summarise the characteristics of each.

Thus the elevated type has the advantage that it can be used as a rotating single-aerial system. It has a high pick-up factor and its standard-wave error may be made low by raising it above the ground. It becomes less satisfactory in its fixed-aerial form, however, owing to the greater height above the





The plant of the Switchgear Testing Co. in which Messrs. Ferguson, Pailin participate. (See page 783.) Left: The short-circuit test generator. Right: The outdoor testing cells

ground to which the horizontal members must be raised in order to achieve a low standard-wave error and reasonably high pick-up factor.

The "U" type has the merit of simplicity and of high pick-up factor, but its standard-wave error, even when screened, remains high. The coupled type, with which may be grouped the balanced-coupled type and the chain type, can be made to possess a very low standard-wave error. It has, however, a lower average pick-up factor than the others. The balanced type, on the other hand, has a good pick-up factor but its standard-wave error has not yet been reduced much below 7 deg.

Development is possible in connection with all of the types to improve their all-round performance. The elevated and coupled types might be combined with advantage in respect of standard-wave error. The coupled type might be improved by introducing aerial tuning with matched transmission lines and again by studying the effect of inserting earthed screens between the transformer windings. The "U" type would give better results when worked with very high aerials on soil of high conductivity, possible artificially improved over a large area in the locality of the aerial system.

The work was carried out by the Radio Research Board in co-operation with the National Physical Laboratory.

Encouraging the Use of Electric Vehicles

AT the informal meeting of the INSTITUTION OF ELECTRICAL ENGINEERS in London on November 26th Col. G. D. Ozanne opened a discussion on modern electric vehicles. He said that the slowness of their adoption in most countries other than Germany and America might have been influenced by the fact that works managers and others were loath to discharge the labour which they would replace.

The inauguration of a hire arrangement for the battery would undoubtedly do a very great deal to increase the use of these vehicles. In the past, prospective users (usually not engineers) were rather frightened at spending from £30 to perhaps £100 on a battery which in their opinion might become irrevocably damaged during the first week of its life. The reliability and operating efficiency of electric vehicles of all types had been proved by many years' use. Their employment for delivery and refuse collection work had effected enormous savings; energy was not wasted during standing time, as there was no engine to be kept running.

Recently a much smaller type of electric vehicle had made its appearance. This was a small van for retail delivery purposes of capacity 5/7 cwt. or 10/15 cwt. Many of these were on the road and their attractive appearance and rapid and efficient movement had proved an excellent advertisement for this class of vehicle. Their running costs were very low owing to the ease of manipulation and the small amount of attention required to keep them in running order.

The speed of electric trucks, varying from 3 to 6 m.p.h., although it might seem low, was ample for all works purposes. The turning radius was very small and when four-wheel steering was provided could be brought down to 3 ft. or 4 ft. from the centre of the truck. The radius of action of a truck on one charge was usually 15/25 miles and it was quite practicable to obtain this under ordinary working conditions by charging the battery overnight. It was most important that the size of the battery should be regulated according to the work. Sometimes, however, distances were very long and working hours were extended, and, in this case, it was usually better to change the battery over in the middle of the day and put in a spare one.

One manufacturer had recently designed a dual motor which was essentially two motors in one frame. By this means a really powerful motor was obtained for climbing severe hills at a moderate speed and a high-speed motor was available for use on the level. Three-wheelers, specially designed for an extremely small turning radius, could be fitted with a controller and steering lever operated from the side, enabling the roundsman to move from door to door without actually having to enter his vehicle.

There was a tendency on the part of purchasers to allow insufficient battery capacity, and it was most important to examine the particular country and insist on the battery recommended being fitted. However, 15/20 miles per day was the average mileage for local delivery.

Mr. L. Murphy said that the English practice of assembling and adapting parts made by different factories had often resulted in vehicles that were wasteful. Much more support was needed, and he felt that supply engineers had not done enough. They ought to be clamouring for them! Instead, they had to be pleaded with to give them encouragement and facilities. Mr. A. F. Harmer thought all supply engineers could look forward to a very useful night load from charging electrics. Mr. E. S. Waddington hoped that independent tests of running performances, like those made on petrol cars, would be arranged by the Electric Vehicle Committee. With the co-operation of charging authorities good educational work should result.

Superheaters for Water-tube Boilers

THIS is the subject of the paper by Mr. H. E. Geer which was read before the London Local Technical Group of the ELECTRICAL POWER ENGINEERS' ASSOCIATION on December 3rd.

The author says that while the economy obtainable by the use of superheated steam depends on the type and size of prime mover and on the initial pressure and condenser vacuum, the reduction in steam consumption may be approximately 1 per cent. for 13 deg. F. of superheat under modern conditions and the saving in fuel consumption about 1 per cent. for every 30 deg. F.

Superheaters for water-tube boilers may be divided into the integral convection, integral radiant, and integral combined convection and radiant types. In addition to satisfying fundamental requirements of design, single-pass construction has important practical advantages. It effects a large reduction in the number of joints, allows of the provision of efficient supports and facilitates the installation, inspection, and removal of elements.

Heat transferred by radiation from the gases does not increase at the same rate as does convection heat transfer. Consequently with a superheater situated near the furnace, at low ratings the radiant transfer is proportionately high and at high loads proportionately low, resulting in a comparatively slight gradient, whereas with convection the heat transmission is proportional to gas flow and results in a rising gradient with increase in load. For this reason, apart from the advantage of reduced size, due to placing them in a high temperature gas zone, modifications in boiler design have been made to allow superheaters to be situated near the furnace, where the combination of radiant and convection heat transfer can be obtained.

With the advent of water cooling firing rates have been considerably increased and the amount of excess air reduced to the minimum. The result is that as much as 60 per cent. of the steam is generated before the gases pass through the boiler tubes at temperatures some hundreds of degrees lower than would be the case without water walls. Consequently, the heat and gas quantities available for superheating are considerably reduced.

One of the "intertube" superheater's most important advantages is its effect on boiler efficiency. Placing the superheater tubes in the lanes between the boiler tubes results in more effective sweeping of both by the combustion gases. With higher superheats and the placing of the elements near the furnace, it is not always advisable to arrange the high-temperature portions of the elements where they encounter the entering gas. As, under these conditions, a large proportion of the heat is transferred by radiation, parallel contra-flow can be adopted with advantage. For instance, in a ten-pass element of this description the steam, after traversing the upper tube, passes to the lower tube and runs in parallel flow to the gas along four tubes, after which it travels contra-flow for five further passes. The gases are thus somewhat cooled by low temperature steam before reaching tubes in which the final superheat is effected, and the danger of overheating the metal is considerably reduced.

It is common practice, in wide boilers, to provide separate right- and left-hand superheaters, each with its separate steam inlet and outlet connections. The principal advantage of this arrangement is the reduced size of headers and steam pipes. Experience, however, has shown that, due to uneven firing and gas distribution, the difference in final steam temperatures at the two outlets may vary by as much as 100 deg. F. A method of balancing has been successfully applied. The superheater is not only divided across the boiler, but also there are rear primary and front secondary sections to each half. The important feature, however, is the crossing over of the pipe connections so that the right-hand primary superheater is coupled to the left-hand secondary, and *vice versa*.

As before mentioned, the convection superheater gives a rising temperature gradient as load increases. The radiant superheater, however, has an opposite characteristic, and for this reason a properly designed combination should give an ideal result. There are three possible combinations, viz., primary convection and secondary radiant, primary radiant and secondary convection, and the two in parallel. The first-mentioned has the advantage that the convection heating surface can be used efficiently and kept to a reasonable size because the gas has a comparatively high temperature potential over that of the low-temperature steam. In the second

arrangement the convection superheater has to be larger because it has to deal with steam already superheated, but the radiant superheater is protected by the cooling effect of low-temperature steam. The parallel arrangement necessitates the employment of long steam paths in both sections to give the requisite protective steam velocity for a reduced quantity of steam flowing through each section, and approximately the same total surface is required for heat transfer.

The Economics of Automatic Boiler Control

THE commercial aspect of good metering and automatic control in the boiler house is stressed in the paper by Mr. S. J. Clifton which was read before the London Branch of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS on December 4th.

The disadvantages of manual control are stated to be the serious time lag between indication of load change and the ultimate stabilisation of the boiler at its new rating. The adjustments made to meet load demand are of an experimental nature and will differ in ratio to the experience of the operator. There is difficulty in maintaining satisfactory load distribution in a battery of boilers subject to variable load.

For these reasons it is usual to keep part of a battery working at the most economical load, while the remainder is used to take the load variations, and, in consequence, suffers in efficiency. When it is considered that the cost of metering equipment is a very small proportion of the total cost of steam-raising plant, it seems very unfortunate that rule-of-thumb methods should be adhered to.

If it can be proved that scientific equipment is available which controls the boiler plant with such accuracy that there is obtained an efficiency which is an exceedingly close approximation to that obtained on test, one would appear at least to have found some satisfactory method of dealing with some of the losses in thermal efficiency of steam-raising plants. If, in addition to this, the advantages of a reduction in maintenance charges of furnace refractories and stoker equipment, &c., are obtained, the equipment becomes of considerable commercial importance.

The rate at which steam shall be produced is determined by master controllers that respond to pressure changes resulting from variation of steam flow consequent on load fluctuation. This is achieved by the master controllers transmitting electrical impulses which cause subsidiary controllers to alter the air, fuel, water, &c., feeds, as required, to preserve the right furnace-draught conditions.

Kent electrical controllers are described, and it is claimed that the use of this system at the Hackney power station for the past two and a half years has shown that it enables boilers to be operated at their designed efficiency levels. Among examples of application it is shown that equipment for four water-tube boilers of 150,000 lb. p.h. each to enable complete or partial automatic control, or remote manual or hand control, to be exercised at any time would cost about £3,000. A saving of 2 per cent. in fuel consumption would mean an annual saving of about £2,400, indicating that the outlay could be recovered in eighteen months, apart from possible reduction of maintenance charges and saving in labour.

* * *

Some Physical Papers

Among the papers submitted at this evening's meeting of the PHYSICAL SOCIETY in London is one in which Dr. L. F. Bates and Mr. D. V. Reddi Pantulu describe how pure amorphous manganese prepared *in vacuo* was found to be paramagnetic, without trace of ferromagnetism, and to obey the Curie-Weiss law. A paper by Mr. L. H. G. Dines deals with the potential acquired in the natural electric field by a vertical rod standing on the ground, insulated at the bottom and carrying a collector at the top. Data of a direct observational comparison between such a rod and a standard piece of apparatus are given. The main part of the paper consists of a theoretical determination of the potential of the rod by means of an approximate solution of the integral equation involved. The investigation is extended to cover a certain range of values of the ratio of the diameter to the height of the rod. An attempt is made to indicate the distribution of charge on the surface of the rod in a special case. An estimate is made of the subsidiary error involved when the collector takes the form of a horizontal fuse which shortens as it burns away. For time-marking a cathode-ray oscillograph by means of harmonics Dr. L. F. Richardson has arranged the oscillograph to act also as a triode giving retroaction in a tuned circuit where one of the harmonics of the trace-frequency is selected and applied to the Wehnhelt cylinder so as to modulate the focus of the trace. A demonstration of the properties of "Mumetal" as applied in an earth inductor compass is to be given by Captain O. E. Chapman.

An Electrically Driven Ore Transporter

THERE are many interesting applications of electricity at Messrs. Stewarts and Lloyds' steelworks, Corby (as we have already indicated in previous issues), particularly among the heavier plant. A recently installed 25-ton ore transporter for feeding the blast furnaces is driven and controlled electrically. The structure is designed to hoist 12½ tons of ore 80 ft. in the air at a speed of 130 ft. per min.; traverse the stock space at 480 ft. per min.; and travel longitudinally over the 600 ft. length of track at 65 ft. per min.

The transporter consists of main bridge girders embodying the track for the grab trolley, supported on two legs placed at 140 ft. span rail centres. One leg is fixed, with a substantial raking strut to take all end thrusts due to working, while the other is of the pendulum type to allow for temperature variation in the length of the main girders or unevenness of track. Both legs are of the open-type to enable the trolley to pass through and work on the cantilever extensions (49 ft. 6 in. and 66 ft. 9 in.) at each end of the transporter.

The transporter track is 38 ft. above the ground level of the stock space, and the legs give a 44-ft. height from rail level to the underside of the girders, making a total clear height of 82 ft. from ground level. The main girders, of lattice arch formation, are 256 ft. long, the trolley track being carried on rail girders at the level of the bottom boom of the main girders. The transporter is carried on sixteen wheels having roiled steel tyres shrunk and pinned on to cast steel centres, arranged in four sets of four each in compensating bogies to equalise the load on the wheels. The longitudinal travelling motion is operated by a motor situated at one side of the main girders in the centre of the span, driving through suitable gearing four wheels on each sill.

The trolley consists of a substantial steel framing carrying the motions for closing and hoisting the grab, and for cross-traversing the trolley. The operator's cabin, from which all motions of the transporter are controlled, is suspended from the underside. Easy access to all parts is provided for by full-length platforms on each side of the main girders, and ladders and landings on each leg and the trolley.

In addition to the solenoid brake on the longitudinal travelling motor shaft, an automatic storm brake is fitted, consisting of massive shoes bearing directly on to each track rail and operated by means of weights running on inclined planes. This brake is so interlocked with the main longitudinal travelling motor that it is applied and released entirely automatically every time the motor is stopped and started. This, in combination with locking pins on the bottom sills engaging with brackets bedded in the concrete foundation, enable the transporter to be positively held in a stationary position.

The large bucket-type grab (15 ft. 9 in. high, 12 ft. 1 in. long, 7 ft. 9 in. wide, closed; 17 ft. 9 in., 18 ft. 9 in., 7 ft. 9 in., open) has a capacity of 12½ tons of iron ore (100 lb. per c.f.),

An end view of the transporter with open grab at full height

and is operated from the trolley by four ropes, two for suspension and two for the opening motion. It is fitted with manganese steel straps (14¼ in. by 2 in.) to take the wear, and can be opened at any height and hoisted in the open or closed positions. The transporter was constructed by Messrs. Thomas Broadbent & Sons, Ltd., Huddersfield.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Machinery and the Factory Regulations

The recent Machine Tool Exhibition gave another demonstration of the advance which has been made in the use of electricity for a wide variety of purposes in industry, but I was surprised at the number of exhibits which did not comply with the Electricity Regulations under the Factory Acts.

Unlike the I.E.E. Wiring Rules, these Regulations are legally enforceable, and it therefore seems a little ridiculous to offer apparatus essentially of an industrial, as opposed to domestic, character unless it complies with them. It is surely not unreasonable of the purchaser to expect that the manufacturer will have made himself familiar with the requirements, and it would be interesting to have the views of your legal correspondent on the question of liability should the use of the apparatus result in an accident, or alternatively should the user be compelled by a Home Office inspector to modify it.

The Regulations themselves set out the requirements on broad lines, but there is also an extremely useful booklet (Form 928) by the Senior Electrical Inspector of Factories commenting on the various points in detail, in addition to which I have always found the inspectors themselves only too willing to advise on doubtful points. STROBOS.

December 3rd.

Liability for Consumers' Apparatus

The article on page 708 of the ELECTRICAL REVIEW dated November 23rd on the above subject raises two very important points :—

(1) The liability of the manufacturers of electrical apparatus who do not supply their apparatus with an effective earth lead or three-core cable, particularly such apparatus as kettles, irons, and all other appliances which have metal bodies.

(2) The liability of the contractors who install plug sockets of a two-pin type, which have no provision for the effective earthing of the apparatus, and plug sockets that are not effectively protected by an overload device, and designed and constructed in such a manner that the user cannot obtain a shock when withdrawing the plug.

It is certain that the sooner the manufacturers and the contractors realise their responsibility the better it will be for the electrical industry as a whole, and it will tend to stop a lot of the cheap apparatus which is being placed on the market, in which no care is taken for adequate protection.

WATMEL WIRELESS CO., LTD.,
A. E. WATKINS, *Managing Director.*

Edgware, Middlesex, *November 29th.*

The E.D.A. Films

In your last issue I noted with interest the comments on this subject. As the engineer of a respectably sized undertaking I was tempted to go to London to see for myself the wonderful production we have heard so much about, particularly in view of the fact of the elaborate literature which has been sent out announcing " £12,000 for You." I am now conscience-clear that I did not spend my Council's money, but I did visit the pre-view in Leeds.

Surely the impression gained speaks for itself; to my mind the whole productions want " fading out." Imagine after spending this amount of money having to delete certain " shots " which are likely to be offensive to the female sex and to our competitors.

I can well imagine that if the members of my Committee had seen the films and the waste of such a large sum of money they would have discontinued their subscription to E.D.A. Surely the minds who conceived the films are capable of conceiving something more beautiful and satisfactory for £12,000. The film will certainly not be shown in my town.

December 1st. FOOD FOR THOUGHT.

The I.E.E. Regulations

In their letter in your issue of November 30th ult., Messrs. Everett, Edgcumbe & Co., Ltd., refer to a three-pole switch having two overloads and a 30-mA leakage trip, the cost being £3. The rating is not stated, but it is obviously less than 50 A, since they agree that the latter may cost £8.

The Commissioners' Regulation No. 28 restricts all services up to 15 kW to a d.p. supply; it therefore follows that if at such a service the earth resistance exceeds one ohm, the leakage device must control a 15-kW circuit and at 230 V this means a 65-A switch. A high earth resistance implies a rural installation which, to justify the cost of a service probably involving a long overhead line, will require a cooker, heating and lighting load for which a 50- to 60-A switch is needed.

Messrs. Everett, Edgcumbe are correct in stating that the extra cost of a 30-mA leakage trip is a moderate proportion of a circuit-breaker's cost, but this assumes that a circuit-breaker would be required in any case. It is quite another matter if a circuit-breaker must be specially provided in order that the 30-mA relay shall prove effective. To protect the above rural installation the cost of a special circuit-breaker plus relay would discourage that type of installation.

The switch illustrated in my letter published in your issue of November 23rd was an example of a cheaper means of providing protection, not only for rural installations, but for 50- to 60-A services where an earth leakage to a domestic water pipe might prove dangerous. The switch can be tripped with either 30 mA or 10-A earth leakage.

I have recently been informed that I.E.E. Regulation 1332, which specifies a d.c. test for switches, does not apply to a.c. apparatus, such as meters, thermostats and like relay methods of control, and so the experimental switch does not conflict with the Regulations. I am still of the opinion that an I.E.E. committee having power to certify new apparatus would greatly assist the development and invention of much needed equipment to meet operating conditions. A. G. BULLEN.

Liverpool, *December 3rd.*

Earth Leakage Protection

Many letters have recently appeared in your correspondence columns on the subject of earthing and earth leakage switches which indicate that the difficulties encountered in rural areas where public water supply systems are non-existent are not fully appreciated and, moreover, that the available methods for providing the necessary protection are not widely known. As, through force of circumstances, we have had to deal with this problem, which has occurred in an acute form in the greater part of this supply area, the results of our investigations and experience may be of interest to your readers.

After carrying out a series of tests and experiments with various types of earth electrodes, it was realised that it was quite impracticable to obtain low-resistance earths by this means, and that the only solution was to use some type of earth leakage protection. Consequently several earth leakage switches of Continental manufacture were obtained and, after test, used in various installations which, to date, have given satisfaction. As these switches were of foreign manufacture and were somewhat costly, certain British manufacturers were approached with a view to producing a suitable earth leakage switch.

After two years' experiment both in the test room and under actual service conditions, suitable earth leakage switches of single-pole and double-pole types, 15 A and 25 A sizes, have been produced at prices ranging from 8s. 6d. to 30s. each. These breakers will operate on various leakage milliamps., 20 to 30 according to the impedance of the trip coil, the resistance of the earth electrode and the inertia of the operating mechanism. A small 15-A breaker capable of withstanding an overload of 100 per cent., made by a well-known manufacturer, has recently been produced which will operate on 24 mA at 44 V. This is considered very satisfactory as it will definitely prevent any dangerous rise in pressure on electrical apparatus.

There are also types which have been designed on the relay principle, *i.e.*, the earth leakage coil closing an auxiliary circuit energised from the power supply which in turn operates the tripping mechanism. This type, although it may require less power to actuate it, is more expensive, and consequently for rural work, where cost must be kept to the absolute minimum, is not so suitable. Although some of these switches have been fitted with a testing switch this is not considered essential and it is felt, therefore, that the supply authorities' own staff can easily make a periodical test by flashing a test lead either directly or with a test lamp in series.

As a result of the experience gained, the following general procedure for rural installations has been adopted :—

1. Where possible an " all-insulated " installation is used. It is recommended, however, that where cookers, kettles, washboilers, &c., are installed an earth leakage switch shall be provided. In this case the method adopted is to install the main switch and fuse (with solid neutral) at the meter position and to use a single-pole earth leakage all-insulated circuit-breaker as the control switch at the cooker. When a kettle is required a three-pin switch-plug is mounted on the same panel, the whole equipment costing 14s. The cost of this control unit thus compares favourably with that of a standard cooker control unit.

2. Where the installation is carried out in steel conduit or

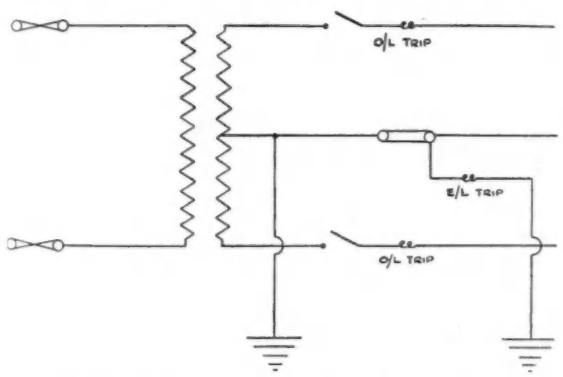
lead sheathed cable an earth leakage switch is provided and two methods are adopted, viz., (a) a standard metal-clad switch fuse (with solid neutral) is provided and, in addition, a single-pole earth leakage switch fitted in the phase side is installed. Alternatively, (b) a double-pole overload and earth leakage switch is installed in lieu of the standard main switch and fuse.

The general behaviour of these switches or breakers is satisfactory with earth resistances as high as 400 ohms. The type of driven earth electrode used is immaterial as an increase in length or section is of relatively small importance in reducing the earth resistance. A 3-ft. extruded copper earth rod is used which is driven into the ground, and the top of it is left at least 6 in. below ground level and is covered by a protecting tile so that the connections cannot be interfered with. These rods are available at prices ranging from 2s. each. The connecting earth wire used is not less than 7/.036 tinned copper and is suitably protected, where necessary, against mechanical damage or interference.

Tests under actual operating conditions have frequently been made, *e.g.*, a person has stood on an earth wire and touched the metal-work of a cooker and this in turn has been flashed by a phase wire at 230 V without any unpleasant effects being felt.

The question of obtaining low resistance earths in rural districts not only applies to consumers' installations but also to the earthing of the neutral at the transformer and it has been found that, notwithstanding numerous attempts to obtain low resistance earths by means of earth plates sunk to various depths and embedded in crushed coke and with driven pipes treated by salt and other chemicals, in particular areas such as old river beds, sandy subsoil and rocky hillside, it was impossible for the resistance to be brought down below 10 ohms. Even the obtaining of this comparatively low figure necessitated the installation of numerous earth electrodes distributed over a wide area at a very high cost, with the result it was decided to install in addition to the "solid" earth required by the Regulations, earth leakage circuit-breakers to control the distribution line.

The breaker is equipped with overload trip coils on the phases and with a leakage coil operating on a variable earth leakage of 25/50 mA at 50 V. The earth electrode for these breakers must be kept out of the "solid" earth zone otherwise the switch will not operate satisfactorily. To illustrate a particular case, a main earth for the transformer and neutral was found to be 50 ohms, which would operate an automatic oil switch or blow a fuse on the 11-kV side, but of course would not permit the fuses or circuit-breaker on the l.p. side to function. An earth leakage breaker was installed and, although this was connected to an earth electrode with a resistance of 150 ohms the breaker operated satisfactorily



Earth leakage circuit-breaker for mains distribution

with leakage currents as low as 100 mA, 75 per cent. of which was returned *via* the "solid" earth. This arrangement works very satisfactorily and can be adjusted to give discrimination between the consumer's and the main circuit earth leakage trips. A diagram of connections is shown in the accompanying sketch.

The views of other engineers engaged on rural electrification would be greatly appreciated. J. S. PICKLES.

Marchmount, Dumfries, *Dec. 3rd.* D. ROSS.

A New Architectural Lamp

The article on this subject in your issue of November 30th is interesting to me because I was concerned a few years ago in the introduction of the long tube architectural lamp that is now in general use here. Previously the only system available was "Striplite," consisting of short lengths of tube lamps about 10 in. long with end contacts, consequently showing black patches where the tubes joined. Nobody seems to have endeavoured to make these tubes agreeable to the eyesight, and their clear glass and exposed filaments were certainly not things of beauty. The length was limited by the use of a glass spine which supported the filament. The glass spine also prevented any other than straight lengths being produced.

It was not until some genius thought of the idea of using a molybdenum spine supporting the filament and insulated from it by small glass beads that improvement was effected. The filament was centralised in the tube by tiny metal spiders. The inventor very wisely used a special glass which gave a pleasant lighting effect having the appearance of a bar of light. The filament and supports were entirely obscured. The advantage of the metal spine was that tubes of considerable length could be manufactured, and, further, single-ended tubes could be made because the spine acted as return circuit. A further improvement was using side instead of end contacts, which enabled a number of long bars to be connected together forming continuous lines of light. The tubes can be bent to any reasonable shape or even tied into knots.

Messrs. Selfridge's were the first to realise the advantage of these long tubes and used them for lighting their show-cases and then to obtain decorative effects in shop windows and the interior of the stores. The tubes spread into shops, restaurants, hotels, theatres, and are a common sight in London and other big towns to-day.

From the description of what is called the mica tube lamp I can see no advantage in it, either in cost of manufacture or in lighting effect, and it has the serious disadvantage that owing to the non-conducting spine single-ended tubes cannot be made. It seems quite unnecessary for another type to be introduced, as the metal spine tube is now being made and marketed by most of the big lamp companies, and judging by the number one sees about it seems to meet all reasonable requirements. A. HUGH SEABROOK.

London, E.C.2, *December 3rd.*

A Lighting Stand-by

I think the arrangement stated in your correspondence columns of November 23rd is amateurish and reprehensible for the following reasons:—

(1) In any stores of importance the usual practice is to have every other or third lamp in important positions (counters, &c.) connected to a special circuit with separate fuseboards and mains to the company's intake. (2) To connect an existing circuit by flex and adaptor (maximum current permissible 2 A) to an independent source is out of order and valuable time would be lost.

An alternative system in use in many stores is to have a separate line of lights between counters (one 100-W lamp to every 15 ft. of counter), wired back through separate fuseboards to the undertaking's mains. If this is done in proper order there is very little fear of breakdown. P. E. POOLE.

Wolverhampton, *December 3rd.*

Commutator Mica

In your last issue Lieut. Osborne states that he has never found a flush-turned commutator to be mica ridged. I agree that this trouble does not often arise on commutators of less than 4 in. diameter; but on larger sizes I have experienced so much trouble that I made it a standard practice years ago to recess the micas of all commutators of 4-in. diameter and upwards.

These troubles did not arise during the works test, but after some period of service and only in about 10 per cent. of the output; they were cured by recessing the mica.

The causes of "high mica" are threefold. There may be unequal mechanical wear of the copper and the mica. Even if these two rates of wear are equal there is a tendency for additional wear of the copper due to electrolytic transference from the copper to the negative brush. Thirdly, the expansion and contraction of the commutator in service may cause the mica sections to move sufficiently to become "high."

Whichever may be the cause the period which must elapse before a commutator can get into a bad condition will vary with the hours of duty and with the speed at which the commutator runs. Further, where the electrolytic cause becomes important the current density under the brush (which varies from case to case) affects the length of trouble-free service from a flush-type commutator.

When the micas are allowed to be "high" or "proud" sparking develops and wear of the copper and the carbons becomes unduly rapid, or a generator may fail to excite when started up. In a large number of cases these troubles have been cured by recessing the micas. Not every commutator with recessed mica runs well, and it is obvious that this device will not correct faults of design, of construction, or of maintenance.

What constitutes good under-cutting? First of all the tool. If the cost of a motor-driven cutter is not justifiable, a short piece of hack-saw blade secured to a suitable "strong back"

with an extension for inserting into a wood handle makes a good tool. The thickness of the blade must be reduced by grinding on both sides to be slightly less than the width of the mica.

In applying this tool a few passes should first be made slowly to get a starting groove in the mica, after which the saw can be worked rapidly without running on to the copper. When a recess $\frac{1}{32}$ in. deep has been made, the saw should be inclined slightly to the right for a few passes and then to the left for a while to clear away any mica which may still be left on the walls of the copper; unless this is done the neglected portions may prove as troublesome as though there had been no undercutting.

Oil and grease must be rigidly excluded from the commutator, and a carbon brush having good mechanical properties should be used—a soft graphitic brush tends to fill the grooves between the commutator sections and cause short-circuits. Nothing softer than one of the medium electrolytic qualities should be used for this type of machine. The brush should be a good sliding fit in the brush-holder when the machine is warm, and if not perfectly normal to the commutator should be tilted not more than 15 deg. from the vertical in a direction opposite to that of rotation; the opposite tilt would produce bad chattering and poor commutation, especially on a high speed machine.

Then given absence of vibration, the results should prove excellent, unless there is some other cause for poor commutation which neither flush nor recessed micas can correct.

D. ALAN TRICKETT, A.M.I.E.E.

Manchester, *Dec. 3rd.*

With reference to Lieut. Osborne's letter in your issue of November 30th, the practice of undercutting commutator mica has proved satisfactory in every case that I have met with in twenty years' experience in generating stations. There are, however, certain difficulties that will show up on certain machines and these faults must be dealt with in an individual manner.

While it is dangerous to generalise with regard to commutator faults, I believe that the five difficulties that Lieut. Osborne mentions are traceable to unsuitable brushes. It is of the utmost importance that after completing the process of "undercutting" the sharp edges of the segments shall be removed. This can be done in any convenient manner but the use of an agate-tipped tool has been found to be very satisfactory for this purpose.

Flush turned commutators require the use of abrasive brushes to reduce "high mica" and it has been my experience that these commutators require frequent dressing down with abrasive cloth. When machines have been very noisy it has been my regular practice to lubricate them at intervals to stop brush "screech."

As an alternative self-lubricating graphite brushes can be used with advantage on undercut mica commutators. I am strongly in favour of undercut commutators, but a suitable grade of brush must be used. The opinions of carbon brush manufacturers would be interesting. SHIFT ENGINEER.

December 4th.

As a supporter of the undercutting of commutator micas, I am pleased to reply to Lieut. S. Osborne's letter in your issue of November 30th, but my support does not go beyond 1/64 in.; in other words, just below the surface.

The troubles mentioned in his letter—judging from my experience as an electrical-machinery repairer—are due to excessive undercutting. The undercut is evidently sufficiently deep to hold the carbon dust and copper, causing bridging of the copper segments, the troubles which he mentions, and finally a burn-out of some of the coils in the armature. If the undercutting is within the limit of 1/64 in. the carbon dust and copper which can be the cause of so much trouble will not be held in.

Mr. Osborne is very fortunate never to have seen a flush-turned commutator mica ridged; perhaps he has handled machines only of good make. I have seen commutators become mica ridged after two or three days' running, and if the micas are not undercut blackening and roughening of the commutator bars occurs, causing sparking, excessive brush wear, overheating of the commutator and unsweating of the armature coil leads.

Brush manufacturers can sometimes supply a brush to keep the micas flush, but in many cases this is used at the expense of copper-bar wear, as certain electrical-machinery manufacturers use mica in the building of their commutators which is much harder material than the copper bars.

JAMES W. BUDGE.

Dundee, *December 4th.*

Better Demonstrators

We were interested to read Mr. Vale's article on this subject in your last issue; undoubtedly it will result in more thought being given to this subject by the various supply engineers and manufacturers.

With reference to the training and colleges where it may be obtained, however, we feel that we should like to draw Mr. Vale's attention to the training which can be obtained here. The London School of Electrical Domestic Science, which opened last January, has for its main object the training of demonstrators and saleswomen for the electrical industry. It is the first school in the country to give a complete training in electrical domestic science.

The students attend daily from 10 to 4.15 for a course which embraces electrical theory; cookery, practical and theoretical; laundry; housewifery and household accounts; instruction in the use of electric sewing machines; voice production and demonstration; first aid and home nursing.

Evening classes in electrical theory, cookery and voice production are also held for the benefit of demonstrators and saleswomen already in the industry. The final examinations are taking place next week, after which a number of students will be available for posts. The school is open for inspection, and we should be very pleased to receive a visit from anyone who may be interested.

LONDON SCHOOL OF ELECTRICAL DOMESTIC SCIENCE,
HELEN MINOPRIO, *Principal.*

London, S.W.3, *Dec. 4th.*

The article by Mr. Vale, in the current issue of the ELECTRICAL REVIEW, stressing the necessity for employing more fully trained demonstrators is very interesting so far as it goes, but I really believe that the reason so many householders retain their gas cookers, in spite of changing over to electrical appliances for most other domestic uses, is that they can *see* the flame which provides the heat.

The enclosed-type boiling plate on the electrical cooker, which appears to be the best fool-proof type on the market, does not provide *visible* heat, and it takes a demonstrator with tact and patience, not necessarily degrees, to convince the housewife that it will do all, if not more, than her gas-burner.

If electric cookers are to achieve the popularity which is their due every one sent out to consumers, whether by the supply authorities or local contractors, will have to be followed "home," and a practical demonstration of a meal consisting of dishes usually prepared and cooked in that particular household given. It is of no use to show the skill of the demonstrator or the efficiency of the cooker in a showroom atmosphere where assistants are always at hand to anticipate every want or wish of their chief; also, the best and latest utensils are used, and only one task is performed at a time.

Most housewives have a dozen or so duties to attend to while the cooking is in progress, and it is instruction in the method of being able to accomplish this successfully, with the aid of electricity, that they stand most in need of. Naturally, a person with a wide experience and understanding, and certainly not of immature years, will appeal most to those who are in need of tuition. NINA DYSON RAYNER.

Manchester, *December 4th.*

While agreeing largely with Mr. Vale's point of view as to the need for better qualified women demonstrators, and for the payment of higher salaries, we would like to point out that within the last few years, much has been done through the E.A.W. Diploma and Certificate to raise the status of the woman demonstrator, thus encouraging the possession of better qualifications.

In order to obtain the E.A.W. Diploma and Certificate it is necessary to hold certain domestic science qualifications in addition to possessing a knowledge of electricity, and there are already many demonstrators in the electrical industry who hold domestic science qualifications ranging from an Institutional Housekeeper's Certificate to the Board of Education Teachers' Diploma.

We, as demonstrators, appreciate the work of the E.A.W. in urging employers to demand these qualifications, and to offer correspondingly attractive salaries which will place electrical demonstration work on a comparable status with other professions. The demonstrators themselves, in their Circles which have now been formed in London, Birmingham, Manchester and Liverpool, are endeavouring through their regular meetings, to keep up-to-date and extend their own knowledge which will further the interests of domestic electrification. MABEL G. READING,

Chairman, The London Demonstrators' Circle.

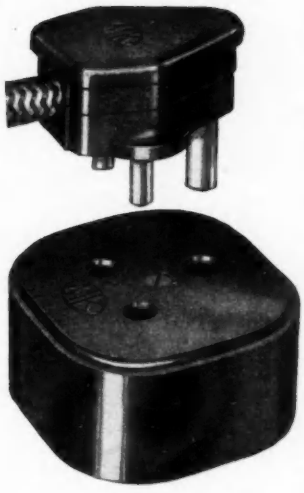
Chiswick, W.4, *December 5th.*

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Three-pin Plugs and Sockets

For plugs and sockets British Standard Specification No. 546/1934 stipulates that risk of contact with live metal must be minimised and other requirements complied with. The new M.K. plugs are shaped to form a natural termination for the flexible, and the socket bases are fitted with covers as small as is possible while complying with the overhang requirements. In the plug the adjustable cable grip is integral with the plug base, finger guards preventing accidental contact with live pins. The bell mouth entry for the cable eliminates the danger of frayed edges, and the M.K. flat terminal is fitted as standard. The spring grip sockets embody a solid ring which encircles the entrance to the socket and prevents distortion of the phosphor-bronze contact limbs, and a steel spring wire to give additional pressure to the limbs, in accordance with the usual M.K. practice.



The new M.K. three-pin plug and socket

There is a wide range of "anti-flash" plugs and sockets, also designed to comply with B.S.S. 546; these are sold at the same prices as the older types by M.K. ELECTRIC, LTD., Wakefield Street, Edmonton, N.18, and are of the two- or three-pin type, designed for surface mounting or sinking into the wall to give a flush fitting.

Scintillating Light Apparatus

The Alliance scintillator

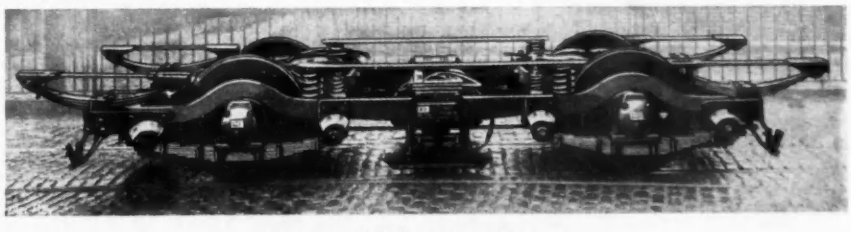
A new type of scintillator is being supplied by ALLIANCE WHOLESALE, LTD., 62, Great Russell Street, London, W.C.1. It is virtually a high-speed magnetic interrupter, which makes and breaks the circuit 120 to 150 times a minute, giving a scintillating effect to a lamp or bank of lamps up to a load of 1,000 W at 200/250 V a.c. or d.c. The effect is a vibrating light and not like that given by a thermal flasher. This device can be used with flambeaux, electric signs, showcards, strip lighting and illuminated displays. The scintillator is housed in a cast-iron watertight case of neat appearance, ready wired for immediate use. A lampholder and adaptor are supplied with the equipment.

A Flexible Axle Truck

The latest type of four-wheel swing-axle truck made by the E.M.B. Co., LTD., Moor Street, West Bromwich, is that mounted on the tramcar of unconventional design that has recently been put into service in Rotherham (ELECTRICAL REVIEW, November 2nd). The springing system employs a combination of coils and long laminated semi-elliptical springs; the latter, instead of the usual horn way guides, carry the driving and braking strains, as in a motor car, an arrangement that reduces noise.

It is claimed that oscillation of the tramcar at high speeds is prevented by the construction of the axle box, which permits the axle to swing to some extent by twisting the springs. The use of "Skefco" radial roller bearings in the cast-steel axle boxes attached to the centre of the springs gives a cushioning effect on corners.

Air brakes are employed for service conditions, and rheostatic and air-applied magnetic brakes for emergency. An interlocking device automatically releases the service brake before the emergency brake is applied.



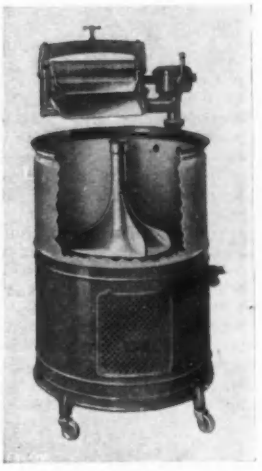
The new E.M.B. swing-axle truck

A Gyrator Electric Washer

We have received particulars of the new "Duco" washer which is being sold by MESSRS. BROWN BROTHERS, LTD., Great Eastern Street, London, E.C.2. The rustless steel tub is made in one piece, being finished with a triple coat of vitreous enamel.

The agitator device has four revolving vanes. It is made from a one-piece aluminium alloy casting and runs on bronze bearings. There is a concealed water sump under the agitator, with a conveniently situated drain pipe and cock screwed to take a flexible hose.

A ¼ h.p. motor which has a radio interference suppressor drives the washer by a shaft through machine-cut reduction gears in an oil-bath case. There is a robustly constructed wringer fitted with a quick-release safety device and with separate control. Provision is made for forward and reverse action of the rollers, and the wringer can be used in six different positions. Mobility is assured by the provision of four heavy castors. The price (20 gns.) includes a lid of rustless cadmium steel.



The new "Duco" washer

A Small Cinema Outfit

Transportable 16-mm. sound-film projectors are used for educational demonstration where full sized 35-mm. equipment is out of the question. The BRITISH THOMSON-HOUSTON CO., LTD., has introduced a new 16-mm. model which is smaller and lighter than its predecessor and includes refinements that ensure clearer and easier projection. The projector optical system is of the tandem condenser type using a 250-W lamp with a mirror reflector, and a screen illumination of 300 lumens is obtained. Only two switches are provided; one has four positions and gives a choice of "sound and picture," "picture only," or "sound only," while the other controls the forward or reverse rotation of the projector. To enable still pictures to be shown there is a device which reduces the light intensity and prevents overheating of the film.

The B.T.H. 16 mm. cinema equipment ready for transportation

The all-mains three-stage amplifier is resistance capacity coupled, using three "Mazda" valves and a rectifier. It gives an undistorted output of 5 W. A 75-W "Mazda" exciter lamp and B.T.H. caesium-type photo-electric cell are also utilised. A new drum-type sound gate procures freedom from ripple and minimum film wear; this device is self-aligning and easily removable. A patented device automatically changes

the drive over from one spool to the other for rewinding or reversing. The standard projector takes 400 ft. or 800 ft. spools, but special spool arms can be provided to accommodate 1,200 or 1,600 ft. of film.

Starting A.C. Slip-ring Motors

Type A.282 push-button starter for a.c. slip-ring motors, made by M. & C. SWITCHGEAR, LTD., Kelvinside Works, Kirkintilloch, Glasgow, is designed for 220/440/660-V single-phase machines of 3.5, 7, and 12 h.p., and for two- and three-phase three- and four-wire motors of 7.5, 15, and 25 h.p. This type is similar in some respects to the star-delta model. The t.p. stator and d.p. rotor contactors have identical fixed and moving copper contacts arranged so that the making and breaking point is remote from the running position.

The arms are mounted on a moulded bakelite crossbar, and arc shields are provided between the contacts. The operating coils provide under-voltage protection and the timing device is actuated by the stator contactor, which upon closing releases a spring-loaded centre-hinged arm, to which is coupled an oil lag restraining plunger with a quick return valve at one end and a contact at the other. After a predetermined time, depending upon spring adjustable setting, contact is made for the coil circuit of the rotor contactor, which then short-circuits the rotor resistance, which is mounted behind the base.

The overcurrent trips are of the hand reset thermal type. Except in the two-phase four-wire pattern the isolating switch is of the "U" blade type arranged for external hand operation and interlocked with the cover.

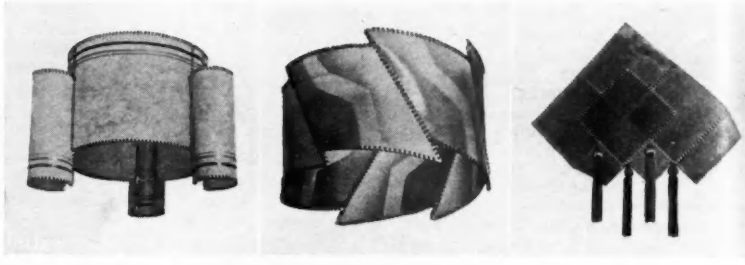
Charging Hand-lamp Batteries

The flexibility of the oxide-cathode system of rectification renders it suitable for the charging from an a.c. supply of large numbers of small accumulators, such as those used in miners' hand-lamps. By connecting a large number of cells (chosen in relation to the mains supply voltage) in series a high overall efficiency can be obtained, as the higher the effective d.c. output voltage the less in proportion becomes the voltage drop in the rectifying tubes. When a three-phase four-wire supply is available a further increase in efficiency is obtained by dispensing with the mains transformer (other than a small one to provide the necessary 1.8 to 2 V for heating the filament of the rectifying tube). With the standard supply of 230/400 V, approximately eighty lead-acid cells per bank will give an overall efficiency of about 75-80 per cent.

The Philips lamp-battery charger

The illustration shows a charger constructed on these lines, with two output circuits, each rated at 80 cells 5 A, and supplied by a separate three-anode rectifying tube. No attention is required during operation, as the charging rate is automatically controlled by special regulator lamps or "barretters" which maintain an approximately constant charging rate irrespective of variations in cell voltage. This feature also permits some variation in the number of cells connected to either circuit without further adjustment. Such chargers can be constructed to meet a very wide range of requirements as the charging rate per bank can be fixed at almost any desired value, while greater numbers of cells are catered for by extending the number of circuits. Where circumstances compel the use of a smaller number of cells per bank it is, in general, inefficient to obtain the required output voltage by increasing the series resistance. The usual practice is to employ a transformer to step down the mains voltage to the required value before applying it to the rectifying tube. The extra cost of the transformer is repaid by the saving in current consumption, and by using several transformer tappings, controlled by a suitable switch, large variations in the number of cells to be charged can be catered for.

These chargers can be constructed for use on either single-phase or three-phase supply, and the output, whether single or multi-circuit, can be designed to meet any requirement. The price is £36, and the makers are PHILIPS INDUSTRIAL, 145, Charing Cross Road, London, W.C.2.

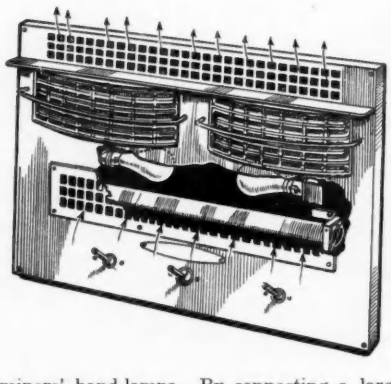


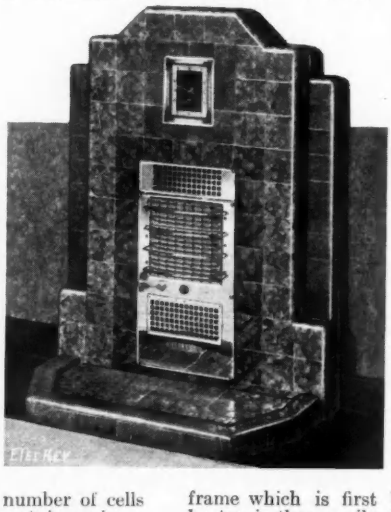
Three shades which have been introduced recently by Furn-Art, Ltd., Sarnesfield Road, Enfield.

The "Harlandic" Fires

MESSRS. HARLAND & WOLFF, LTD., Shipbuilding and Engineering Works, Belfast, have entered the domestic electric field with a type of fire which is unusual in design. Known as the "Harlandic," it embodies the principles of both convection and radiation. The cool air circulates from the lower grill (a double grill is provided at the bottom in the case of the vertical model) behind the radiant firebars, where it is warmed and passes out into the room through the top grill; thus all the heat from the firebar is circulated in the room instead of part being lost through direct contact with the wall. Just behind the lower grill there are two specially constructed bars which, by means of concealed lighting, give the effect of glowing bar heaters when the middle of the three switches is closed.

A "cutaway" view of the "Harlandic" heater showing the position of the lamps and (right) a 3-kW vertical model built into a modern fireplace





The heating panel is chromium plated, and is normally supplied on a stove-enamelled surround which can be coloured to tone with the decorations. This surround has a special frame which is first bolted to the wall, and to which the heater is then easily fixed. When the heaters are required to be mounted in a tiled, slate, or asbestos board surround, the stove-enamelled surround is removed and a special fixing provided for securing the chromium-plated heater to the brick or cement back of the grate. The horizontal model and a 3-kW vertical model fitted into a modern tiled fireplace, incorporating a synchronous electric clock, are being shown at the exhibition of new products which is now being held at the Building Centre, Bond Street, W.

This is a view of the complete "Eclipse" magnetic chuck (Messrs. James Neill & Co. (Sheffield), Ltd.) which was described in our issue of November 23rd when we illustrated the magnetic system only

Whither Service? By C. Mancha Bennett

Film fantasies or practical aid?

THE coming of propaganda by film has completed the process; and now electricity and its uses are going to be as effectually canned as gas in a gasometer. The greatest and most effective advertising agent the supply industry possesses is *SERVICE*, and if it is once again brought out of its wrappings of linen and camphor balls it will show what it can do and how great it really is.

One cannot serve one's god by paying for one's prayers to be said. This in effect is exactly what the supply industry is drifting towards, by letting a film pretend to do the work which should be done by real live artists in the art of salesmanship and real mechanics in repairing and adjusting the apparatus used by consumers.

Will it come to this? Mrs. Smith rings up the local supply company reporting that her kettle is defective, and asking if somebody can be sent round to repair it. The supply company replies, "Madam, you must see Film No. 1934 entitled 'Conjurers in the Kitchen,' now showing at the High Street Cinema, which features June East and Femenine and Chef. All possible breakdowns to kettles, and how to carry out repairs, are introduced into this excellent film."

In these days of servantless houses, the intensive urge to live in all-electric flats, the rush, tear and struggle of motor car users, golf players, dancers—who has the time, or inclination, to watch a film reminding one of the cost of electricity, or, what is a greater deterrent, to be reminded that Mrs. Jones on the other side of the street pays something less for her current?

One ounce of real service is worth a pound of film propaganda. A really good showroom, with efficient and helpful assistants and a really good service staff, covering the twenty-four hours of the day—there is the key to supply development. And after all, in these days, the poorest person in the land understands and appreciates the great advantages of electricity in the home, and all he asks is practical assistance to get it there at a reasonable price, and, when once there, the best costless service to show him the proper way to use it by practical demonstration.

Before it is too late, the supply industry must escape from this "canned" method of education, and return to the two-legged "service servant," working in the three dimensional space that we all understand. Goods will never be sold by film propaganda: one must handle them, turn them over, and judge their usefulness by touch: ask questions, and last, but not least, discover their cost. And this cost must be a cost that all can understand, a direct figure for a direct purchase. Who would buy apples at 4d. per pound, and one penny for the coster's barrow hire?

Perhaps the coming of the new combination for unified distribution in London will bring with it real ideas of progress and service. Perhaps there will be a magnificent central showroom, where all can go to make inquiries, to see, to learn and be told the best for their particular wants; to be thoroughly satisfied that if anything goes amiss there shall be willing and immediate service to attend day or night. That electricity in the service of man shall be electrical service to man, at any hour—that is the goal that should be striven for. Make the supply the big thing it really can be; make the use of electricity as common to all as the air we breathe; cut down the barriers of technical jargon and make the purchase of electricity understandable.

Educate the people by contact with realities, and not by pretty pictures which create a jealous feeling that electricity is only for the rich.

The supply authorities are trustees of a great public service. Are they going to administer that trust wisely, and to the utmost advantage of all the classes of people whom they serve?

The Electricity (Supply) Bill

ON November 29th, Mr. Hore-Belisha, Minister of Transport, in moving the second reading of the Electricity (Supply) Bill, said that the measure was intended to qualify and amplify certain provisions of the Electricity (Supply) Act, 1926, the greatest constructive measure of planning ever undertaken for a single industry in Great Britain. Although that Act had been on the Statute Book for eight years it was noteworthy that this was the first occasion that it had been advisable to ask for any amendment of any of its clauses. This was probably due to the fact that the Central Electricity Board, which was created by that legislation, had proceeded by negotiation and agreement, wherever that course had been open to it, to achieve the purpose which Parliament had in view.

The choice of selected stations having been made, subject to such conditions as from time to time might prove advisable, the Board was confronted with the problem of determining its relations with the various undertakers whose stations had not been selected. Some of those were plainly uneconomic, in that their running costs for generation of electricity were actually greater than the grid tariff, which included the Board's liabilities in respect not only of running costs but capital charges as well.

But there were other stations having some economic life remaining, capable while the present plant endured of producing energy at running costs lower than the grid tariff, although, when their capital charges were added, at higher total costs. In some exceptional cases such stations had lower total costs than the grid tariff. It fell to the Board to determine which of these stations were suitable for permanent use and therefore for selection. In cases where it decided that a station was unsuitable was the Board to leave the undertaking outside the scheme altogether to develop independently? It could not do so under the 1926 Act, which was to co-ordinate the wholesale side of the industry. Accordingly the Board had made it its practice to enter into agreements with such undertakings under which it obtained the use of the stations for peak loads, importing into the station at other times electricity produced at lower cost at the more efficient selected stations, thereby obtaining a contribution to the expenses of the grid which it would not otherwise receive.

To Legalise Voluntary Agreements

These agreements provided for the gradual elimination of the plant, thus hastening the day when the stations would take all their requirements from the grid to the considerable advantage of the selected station owners on the one hand and the consumers on the other. The agreements were entirely voluntary, made between two bodies of business men in each case. The reason for the Bill was that last year two undertakers desiring to enter into such agreements with the Board were advised that, because there was no specific reference in the 1926 Act to agreement-making power, the board was acting *ultra vires*. So anxious were they to conclude the agreements that they promoted private legislation. It was at this stage that his predecessor had to consider the position where Parliament was likely to be confronted with a number of Bills all seeking the same object. The Government thought it would be more convenient if Parliament dealt with the matter comprehensively in a public Bill applying to all.

It was by virtue of its status as an authorised undertaker under the 1926 Act that the Board, like other authorised undertakers, in accordance with the practice of the industry, had entered into this other arrangement referred to in Clause 2. The object of the clause was to enable the resources of the grid to be utilised by all undertakers, great and small, for the purpose of making special prices for an exceptional supply. The alternative was that large industrial undertakings would install their own generating plants and their load would be lost to the grid and to the electrical industry as a whole, perhaps for ever. Thus the advantage which the grid was intended to bring to the industrial community would be gravely restricted.

The Railway Electrification Question

The third clause provided practical means whereby the Commissioners could carry out the duties of apportioning certain transmission costs imposed on them by the 1926 Act. With regard to Clause 4, the Weir Committee recommended that the Board should be given power to provide direct supplies for railway electrification schemes. He had received from the Railway Companies' Association a pressing letter informing him of the great importance which they attached to the passage of this clause, and stating quite categorically that if any further schemes for the electrification of the railways were to be entertained the companies considered it essential that they should have power to negotiate for and to obtain their supplies of electricity direct from the Central Board.

This clause in no sense prejudiced the question of electrification of railways. It only provided that where a railway company decided to electrify its lines it should be able to make a single contract covering its whole system. Adequate safeguards were provided for all the interests that could reasonably claim to be affected, by appending to each clause a provision that the Electricity Commissioners should examine and, wherever necessary, pronounce on the arrangements made.

The Bill was not opposed by the Consultative Committee contemplated by the 1926 Act, comprised of the leading men in the industry, by the Incorporated Municipal Electrical Association, or by the Association of Electrical Power Com-

panies—bodies which together represented 80 per cent. of the industry. He trusted that the House would view this from a national point of view and regard it as advancing the main purpose of Parliament in 1926 in making the supply of heat, light, and power more cheaply and readily accessible for industrial and domestic uses in Great Britain.

In the debate which followed, Labour members supported the Bill, although reserving the right to move amendments in Committee. Approval was given to the principle of further railway electrification in crowded centres. A number of Conservatives, however, urged that the Bill should be sent to a Select Committee. It was, they said, a technical Bill, and should be carefully considered by experts.

Sir G. Ellis, for instance, argued that for the first time the Ministry of Transport, contrary to the 1926 Act, had agreed that in future the Central Electricity Board should be permitted to compete with those who supplied it with the current that it was using. It was a principle which needed careful examination. On the strength of the 1926 Act municipal corporations and the great companies expanded their concerns, but now their goodwill was to be whittled down, with no compensation being given in this process of nationalisation. They could not look on this with equanimity, especially those who had asked the public to subscribe to their undertakings. It would have been far better if the Bill could have gone to a Select Committee.

On the other hand, Mr. Amery said that the Bill would relieve railway companies of the necessity of negotiating with many separate authorities who looked at the matter from a purely local point of view. The present situation was definitely hampering the electrification of the railways. Sir R. Horne said that experience had shown that, even for the short distance from London to Brighton, it had proved impossible for the Southern Railway to make arrangements with all the different undertakers, and it had had to call in the aid of the Central Electricity Board. If they were going to have electrification of the lines they must get rid of clogging conditions of that kind. There was no substantial opposition to this Bill within the realms of the electrical suppliers themselves. It was a purely business matter.

Mr. Emmott, Mr. H. G. Williams, Mr. Bailey, and others favoured the idea of the Bill going to a Select Committee, and Mr. Petherick made the suggestion that the Bill should, after the second reading, be sent to a committee of experts, and, further, that a Royal Commission should be appointed to examine the whole working of the electricity undertakings of this country.

Replying to these and other points, Mr. Hore-Belisha said that they were asking for nothing more or less for the Board than was the common procedure in the electricity industry. No contract was broken, no monopoly was infringed. No clause, or section, or phrase in the Bill interfered with the monopoly of power companies in the area which Parliament had given them to supply. The Board had undertaken the task under the ægis of Parliament and should be given the necessary trust which Parliament ought to repose in a Board of its own creation. Parliament should not allow any theoretical consideration to stand in the way of a great measure of railway electrification.

The Bill was read a second time and, on the motion of Captain Margesson, committed to a Committee of the whole House by 113 votes to 27.

Parliamentary News (BY OUR SPECIAL REPORTER)

ON November 28th, in reply to Mr. W. S. Morrison, Mr. Hore-Belisha (Minister of Transport) said that Sir Andrew Duncan had resigned his position as chairman of the Central Electricity Board on his appointment as independent chairman of the British Iron and Steel Federation. To succeed him as chairman of the Board he had appointed Sir Archibald Page, the present general manager of the Board. He had appointed Sir Andrew Duncan to be a member of the Board in place of Lord Barnby, who had resigned. These changes would take place on January 1st next.

The Belfast Station

On November 28th Mr. Ross asked the Postmaster-General whether he was aware that it was very difficult to hear the Belfast station of the British Broadcasting Corporation owing to weakness of transmission and the interference of Continental stations of similar wave-length; and whether he would endeavour to secure the allocation to this country by international agreement of other wave-lengths which would give to our weaker transmitting stations greater freedom from interference.

Sir K. Wood said that the power of the B.B.C. transmitter at Belfast was 1 kW, but the Corporation proposed to replace it by one of 50 kW, thus improving reception over a considerable area. The construction of the new station had been begun, but it was not yet possible to state on what date it would be brought into use. The demand for broadcasting wave-lengths in Europe far exceeded the number available. The present allocation of these wave-lengths was settled at an International Conference held at Lucerne last year, and it was not at present practicable to make any change in the Belfast wave-length.

Radio Interference

On November 28th Mr. H. Williams asked the Postmaster-General whether his attention had been drawn to the report of the Institution of Electrical Engineers' Committee on Radio Interference and its findings that listeners and those who advised them had not yet done to their own receiving sets all that was possible to mitigate some of the effects of interference; and whether he would request the British Broadcasting Corporation to advise listeners as to the steps they should take in this direction.

Sir K. Wood said that his attention had been called to the report of the Committee and to the suggestion it contained that in some cases receiving sets were capable of improvement to avoid electrical interference. For many years now the Post Office and the British Broadcasting Corporation, working in close co-operation, had assisted listeners in connection with complaints of such interference; and the Post Office was at the present time investigating complaints at the rate of 40,000 a year. In addition the Post Office had shared with the British Broadcasting Corporation and the Radio Manufacturers' Association the cost, which was considerable, of financing research work in connection with the Committee's inquiries. He could assure Mr. Williams that the B.B.C. and the Post Office would continue their efforts to assist listeners in the direction suggested by the Committee.

Closed Generating Stations

On November 28th Mr. Leonard asked the Minister of Transport how many electricity generating stations, municipal and private, existed in this country at the passing of the Electricity (Supply) Act, 1926, and how many had since been closed down under the direction of the Central Board.

Mr. Hore-Belisha said that the official returns for 1926-27 covered 479 generating stations belonging to authorised undertakers (both municipal and company), of which thirteen had been closed before the end of that year. Between that time and the beginning of 1934 upwards of 150 of these stations had been shut down, in a number of cases as the result of the owners taking a direct supply from the Central Board (although not necessarily as the result of directions by the Board), and in other cases in consequence of the owners taking a bulk supply from another undertaker who was now connected to the grid system. During the intervening period, other generating stations, for example, new selected stations, had been constructed and brought into operation.

London Electricity Charges

On December 3rd Mr. D. G. Somerville asked the Minister of Transport what reductions had taken place in the last three years in the various districts comprised in the London area in the price of electricity; and whether the completion of the grid was likely to lead to any further reduction in the near future.

Mr. Hore-Belisha said that including the Joint Electricity Authority, there were eighty-six separate undertakers in the London and Home Counties Electricity District. The reductions in charges made during the last three years were too numerous to give in detail, but as an indication of the downward trend of charges in the Greater London area, the following figures might be given :—

	Average price obtained per kWh sold 1932-33.	Reduction on 1929-30 figures.	
	d.	d.	%
Lighting and Domestic Supplies.			
Metropolitan Borough Councils	1.88	0.28	13
Extra London local authorities	2.04	0.53	20.6
London companies	2.83	0.46	14
Extra London companies	2.68	0.87	24.5
Power Supplies.			
Metropolitan Borough Councils	0.97	0.08	7.6
Extra London local authorities	0.85	0.09	9.5
London companies	0.95	0.17	15.2
Extra London companies	0.84	0.03	3.4

The economies in generation due to the grid scheme were likely to result in increased consumption and further reductions in charges.

Battersea Power Station Fees

THE Court of Appeal, consisting of Lord Justices Greer, Maugham and Roche, delivered judgment on Monday last in the appeal of Mr. Alfred Lane, the district surveyor of Battersea, from the judgment of a King's Bench Divisional Court composed of the Lord Chief Justice and Justices Avory and Talbot, holding that the Stipendiary of the South-Western Police Court was wrong in deciding that Messrs. John Mowlem & Co., Ltd., were liable to pay to Mr. Lane £476 10s. under the Fifth Schedule of the London Building Act, 1930, in respect of the erection of the Battersea power station for which Messrs. Mowlem were the principal contractors. The Divisional Court, however, reversed this decision, and from this result Mr. Lane now appealed. The Lords Justices now held that Mr. Lane was entitled to his fees as claimed upon the ground that the building was erected under the provisions of Sections 58 and 59 and that Schedule V, Part IV of the Act applied. The appeal was accordingly allowed with costs. Leave to Messrs. Mowlem to appeal to the House of Lords was granted on certain terms as to the costs of that appeal.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

A Radio Factory Deal

The Birmingham correspondent of the *Financial News* reports that Mr. C. Herbert Smith, receiver for the debenture-holders of the Telsen Electric Co., Ltd., of Aston, Birmingham, has disposed of the company's main factory and contents to Messrs. Alfred Herbert, Ltd., of Coventry. The company was acting in conjunction with Mr. David Rosenfield, of Messrs. David Rosenfield, Ltd., who have since secured the transfer of the concern. Mr. Smith states that two other factories, which are now idle, have not been sold, nor have the debts and book debts. It is understood that Messrs. Alfred Herbert, Ltd., now have no further interest in Telsen Electric and that Messrs. Rosenfield have full control and intend to continue the manufacture of Telsen wireless components and receiving sets should the market be favourable. Messrs. Alfred Herbert are in no way interested in the manufacture of wireless components.

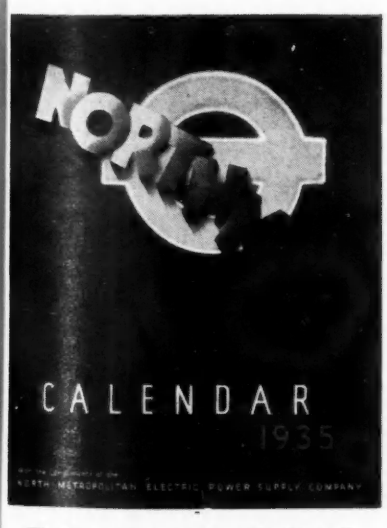
The E.D.A. Newcastle Carnival

The seventh E.D.A. carnival, under the auspices of the Northern Counties Area Committee, will be held in the Oxford Galleries, Newcastle-on-Tyne, on January 11th. The carnival again promises to be one of the outstanding electrical functions of the year. Tickets are available at 5s. each from Mr. A. Parkin, E.D.A. Office, Commercial Union Buildings, 47, Pilgrim Street, Newcastle-on-Tyne. The proceeds of the dance, as usual, will go to the electrical charities.

British Plant for South Africa

The Town Council of Worcester, Cape Province, recently invited tenders for a turbo-generator, and it was stipulated that only tenders for British plant would be considered. Mr. M. Gompels, of the Skodaworks (S.A.), Ltd., complained to the Department of Commerce and Industries of the tendency of this municipality to purchase British goods only. It was explained by Mr. F. C. D. Mann, the electrical engineer (who is also honorary consulting engineer to the municipality) that he had stipulated British because he desired to get the best and most suitable plant. The Council at first deferred the matter, and at a later meeting Mr. Mann said that if they desired him to make another recommendation he could no longer continue as consulting engineer. The Electricity Committee reported that in the electricity undertaking was to be found material and plant from several specified countries. In view of the urgent need of the plant it considered that a sufficient number of tenders had been received to secure a satisfactory choice of first-class machinery, and it again supported the recommendation, which was then accepted.

The " Northmet " Calendar and Catalogue



The front cover of the " Northmet " calendar

The 1935 calendar of the North Metropolitan Electric Power Supply Co., which we have just received, consists of twelve monthly sheets, each of which is headed with a colourful picture of historical interest connected with the area covered by the company. With each calendar the company has issued a catalogue of electrical Christmas gifts. It has printed 167,000 copies of the calendar and catalogue for distribution to consumers in its area of supply, the weight of the paper alone being over thirty-four tons.

Fires

A fire occurred at the premises of the Euston Manufacturing Co., Ltd., Euston Road, N.W.1, on November 29th. Considerable damage was done to the building, plant and stock. The company states that it is doing everything possible to attend to orders already on hand, and with temporary accommodation will quickly be able to resume operations.

A fire occurred on November 30th at the factory of the Three Star Accumulator Co., of Rosebery Avenue, Tottenham, N., when two boys employed in a store-room where sheets of celluloid were kept were burned to death.

The Lighting of Shepherd's Bush Tabernacle

An interesting system of lighting devised by the General Electric Co., Ltd., has recently been installed at the Shepherd's Bush Tabernacle, London, W. Ten hexagonal " Britalux " units, equipped with 200-W Osram lamps, are suspended from the ceiling of the chapel, while a number of brackets—carrying " Superlux " shades and 60-W lamps—are affixed at points where the roof springs from the gallery walls to supplement the lighting of the pendant units. Under-gallery lighting is provided by opal cube fittings, housing

The new lighting installation at Shepherd's Bush Tabernacle

75-W lamps, affixed to small boxes with ball and socket plates. " Britalux " pendants have been installed in the officials' parlour and the deacons' vestry, while the schoolroom has been equipped with " Coolicon " reflectors. Outside the tabernacle a " Claudegen " sign has been erected, with the word " Welcome " in 12-in. block letters. The electrical contractor was Mr. G. Goodchild, of 6, Lime Grove, W.12.

Unqualified Electricians at Preston

At a meeting of Preston Trades Council on November 29th the Electrical Trades Union protested against " jerry and cheap-jack work," and householders were warned not to have anything to do with " amateur electricians." The Union advocated the elimination of the menace of the " cheap-jack." Mr. E. Bristow urged the Corporation Electricity Committee to do something to put a stop to dangerous electrical work. Councillor H. E. Rhodes, chairman of Preston Corporation Electricity Committee, who was present, said the department would investigate any reports of irregularities.

American Electrical Competitions

The Edison Electric Institute is offering a number of prizes for competition in 1935 to employés of companies who are members, for papers on subjects relating to the electric light and power industry. They are as follows :—

Byllesby Prizes of $100, $50 and $25 respectively for the three most meritorious papers on any accounting subject relating to the industry.

Lindemann Prizes of $150, $100, and $50 for three papers on the advantages of electric cookery for domestic purposes.

One Forbes prize of $250 for a paper on public relations in the industry.

Three McGraw Prizes of $250, $150, and $100 for three papers on any engineering or technical subject relating to the industry.

Other awards consist of a gold medal, a cup and a bronze plaque, the first two being accompanied by $1,000 each, for companies who accomplish specific electrical development activities.

Worthing Showroom Inquiry

An inquiry was held at the Worthing Town Hall on November 27th by Mr. H. Nimmo, chief engineering inspector of the Electricity Commission, into an application by Worthing Corporation for sanction to a loan of £17,500 for the provision of new electricity showrooms. The case for the Corporation was presented by Mr. J. K. Allerton (Town Clerk), and the scheme was opposed by Mr. F. G. Stevens, on behalf of the Worthing and District Chamber of Trade, Mr. L. C. Penwill, for the Electrical Contractors' Association, Mr. C. F. Francis (National Citizens' Union and the Worthing Ratepayers' Association), and by Councillor F. W. H. Migeod, as a ratepayer. Mr. Allerton stated that of the sum applied for £7,500 was for

the site and £10,000 for the erection and equipment of the showrooms. The existing showrooms had made no demands upon the rates, and the new showrooms would be self-supporting. The proposal did not involve any change of policy; it was merely the transfer of a business to more convenient premises. Mr. G. Porter, the borough electrical engineer, explained the pressure on the accommodation of the present showrooms both for lectures and for stock. Since it opened in 1931-32, 36,215 articles had been sold, and in addition 25,000 customers had paid their accounts there. He indicated the better accommodation which the new premises would provide. Mr. Penwill said the main concern of the Corporation was to increase the supply of electricity and interest in it. As the result of the examination of their accounts he was satisfied that the principal contractors in Worthing were showing a big loss in turnover. Replying to Mr. Penwill, the Town Clerk said his information was that the contractors were doing better than they were before the showroom was started. Mr. F. R. Cripps, a former chairman of the Electricity Committee, supported the scheme, and said the E.C.A. represented only about six contractors out of a total of about twenty-five in the area of supply. From the others he had heard no objections. Mr. L. Godden, president of the local Chamber of Trade, considered the showroom to be an abuse of municipal trading, and he thought it extravagant and unnecessary. The Commissioners' decision will be issued in due course.

Accumulator Manufacturing Losses in France

One of the largest manufacturers of storage batteries in France, the Dinin concern, reports a loss of 3,780,000 fr. for the past year; this is covered by the emergency fund. In his report, the president points out that this loss has been due largely to the disappearance of an export market and to the fall in prices, which brings them below the actual cost of production. These factors seem for the present to continue to exert their influence, but being in a sound financial position, the company hopes to do better as soon as the situation shows the least improvement.

" How to Joint "

We have received from W. T. Henley's Telegraph Works Co., Ltd., the eighth of its series of " How to Joint " booklets. This one is entitled " How to Install Ironclad Iscos," and fully describes each progressive stage in the preparation of the cable, the assembly of the " Isco," and the wiring of the fuse. A third edition of the booklet on " E.h.t. Joints " is now available.

A Lamp Sales Aid

An idea to assist retailers to sell Royal " Ediswan " lamps in half-dozen lots instead of smaller quantities has just been introduced by the lamp sales organisation of the Edison Swan Electric Co., Ltd., in the form of strong cardboard containers for six lamps. A decorative treatment in four colours on one side of the carton suggests the six lamps as " A Present for the Home," while the reverse side of the package provides an intriguing picture for the children to colour. The new

A PRESENT FOR THE HOME
BOX OF 6 ROYAL EDISWAN COILED-COIL LAMPS
BOX OF 6 ROYAL EDISWAN COILED-COIL LAMPS
20% more light for the same cost

The new " Ediswan " lamp container

package is a useful aid for Christmas window displays and special showcards are also available.

Recent Contracts

Amongst other business recently received, the English Electric Co., Ltd., has secured orders for two 3-K type Diesel engines for the Kut barrage, Iraq. Each will develop 150 b.h.p. at 600 r.p.m., and will be connected to an English Electric 100-kW alternator generating power at 440 V, 3-phase, 50 cycles; also all motors and control equipment for the gravel plant, motor-driven pumping sets, &c. For the Assiut dam, the company is supplying three 6-K type Diesel engines, each developing 300 b.h.p. at 600 r.p.m. They will be direct coupled to 200-kW, 550-V d.c. generators. The contract also includes motor-generator sets, motor-driven pumps, a complete transmission line across the dam, and all power house equipment.

An exceptionally large kiosk, measuring 16 ft. by 6 ft. and 11 ft. high, built by Messrs. Crompton Parkinson, Ltd., at Chelmsford, has just been shipped to Canada for McKinnon Industries, Ltd., to the order of their agents, Bepco Canada, Ltd. The equipment includes 28-in. round tank oil circuit-breakers designed for a rupturing capacity of 350,000 kVA and a meter panel fitted with recording wattmeter, recording power factor meter, polyphase watt-hour meter, &c. The kiosk has been specially constructed for use in a climate where the temperature ranges from 95 deg. F. in summer to minus 15 deg. F. in winter.

The accompanying illustration shows a number of sterilisers which form part delivery of a large order recently received by

A consignment of electric sterilisers

the Medical Supply Association, Ltd., for the Willesden Maternity Hospital. The photograph was taken outside the company's premises whilst the order was being loaded on to one of the company's vans for delivery.

A new welding plant has recently been constructed by Murex Welding Processes, Ltd., for the Miller Timber & Trading Co. for use in Western Australia. The set consists of a single-cylinder British Junkers Diesel engine of the two-stroke type with opposed pistons developing 12 h.p. at 1,500 r.p.m. The dynamo is the Murex drooping characteristic type, requiring no separate excitation or stabilising devices, and in this particular case has an output of 200 A at 30 V. The machine is fitted on a two-wheeled pneumatic-tyred trailer, with automatic brakes and folding jacks. On each side long, narrow boxes are provided for carrying electrodes, spare parts, tools, &c., whilst at the front end of the set a deeper box is fitted for storing cables, electrode holders, screens, &c. Removable steel doors are supplied to totally enclose the set, which, complete with trailer, weighs only 26 cwt., and is therefore capable of being towed by a small car or lorry.

The Richard Garrett Engineering Works, Ltd., of Leiston, Suffolk, has recently received a repeat order for three 5-ton electric vehicles for the Glasgow Corporation Cleansing Department. These vehicles will be fitted with pneumatic tyres and Tudor batteries.

In connection with the development of a new port for the Chinese State Railways in Honan, the Fraser & Chalmers Engineering Works of the General Electric Co., Ltd., Erith, Kent, has just secured a contract for a complete power station, a coal storage, reclaiming and shipping plant, and handling equipment for general merchandise. The power station will house four steam turbo-alternators, two of which are now in process of manufacture; each will comprise a geared turbine of the standard high-pressure type, coupled to a " Witton " alternator rated to develop a normal output of 500 kW. The coal handling plant commences with a wagon tippler to handle all trucks from 10 to 40 tons capacity, tipping through belt feeders on to storage conveyors, which make, through a mechanically propelled tripper, a stock pile 60 ft. high and about 1,600 ft. in length. Under the pile will be a concrete tunnel for reclaiming the coal through gates on to a conveyor, and then on to the loading wharf to load vessels through the medium of a travelling loading tower, with an outreach of about 70 ft. Incoming coal can also be shipped direct by short-circuiting the stock pile and delivering directly on to the conveyor in the tunnel. The capacity of the plant is to be 400 long tons per hour of run-of-mine coal, and of the stock pile 84,000 tons live storage or 167,000 tons total storage. The coal will be automatically weighed into the stock pile and also into boats by belt weighers. In all over 5,000 ft. of 30-in. belt conveyors will be installed. For handling merchandise at the port, the plant will include three 3-ton electric level luffing cranes, four 2-ton overhead travelling cranes, two 2-ton mobile electric cranes, and six gravity roller conveyors, each 24 ft. in length, for conveying packages and similar merchandise.

Social Events

The first annual dinner of the staff of the Birkenhead Corporation Electricity Department was held on November 29th at the Queen's Hotel, Birkenhead, under the chairmanship of Mr. F. E. Spencer, M.I.E.E., the borough electrical engineer.

Mr. Southall (chief clerk) proposed the toast of the continued success of the electricity undertaking, to which Mr. Spencer responded. The opportunity was taken to present gifts to Messrs. S. E. Hunt and F. Williams, who were recently married. After the dinner there was an excellent concert.

The Callender Athletic and Social Club drew a large company to King George's Hall, London, W.C., on Tuesday evening to enjoy a rendering of "A Damsel in Distress" (Ian Hay and P. G. Wodehouse) by the Dramatic Section. The comedy involves a large cast and great credit is due to everybody who contributed to a performance which sustained interest throughout in an atmosphere of mirth. Mr. Howard Foulds, the founder of the Club, was as usual in very happy form as he paid a tribute to those who had put in the hard work behind the scenes making special mention of the producer, Mr. Stuart Mackenzie, Mr. E. A. Bridge, who once again filled the office of honorary secretary and business manager, and Mr. E. J. Hart, the assistant business manager and treasurer. Mr. Foulds was to convey the good wishes of the company to Sir Tom Callender, the head of the Callender's Cable Co., for his continued good health and he expressed their pleasure in having Sir Tom's son and daughter with them.

The annual dinner and prize distribution of the Electricity Supply Rifle League was held at the Maison Lyons, Shaftesbury Avenue, W., on December 1st. Mr. J. R. J. Bowden (Hackney), the president of the League, presided, and was supported by Messrs. E. A. Mills (Hackney), W. Weekes (Shoreditch), P. C. Ebner (Shoreditch), and representatives of various London power companies, including Messrs. R. S. Downe (Brompton and Kensington Co.), J. MacLaren and S. G. Nodes (London Power Co.), and G. C. Weston and Major Trundle (Kensington and Knightsbridge Co.). Mr. E. Matthews (Hackney) referred to the year's activities, and complimented the champions of the various divisions, who were as follows.—First division: London Power Co. Second division: City "B." Third division: Brimsdown "A." Fourth division: Fulham. Mr. Weekes proposed the toast of the chairman and Mr. Bowden responded

The ninth annual staff dinner and dance of the Lancashire Electric Power Co. was held at the Manchester Midland Hotel on November 29th, and it proved to be one of the most successful on record. An hour's dancing preceded the dinner at 8.30 p.m., and afterwards—until well beyond midnight—the ballroom was thronged with happy couples. Mr. C. D. Taite, engineer and manager, attended, together with other members of the executive. The company numbered nearly 200, including members of the staff and their friends from all parts of the L.E.P. area.

The annual dance of the Bristol branch of Philips Lamps, Ltd., was held on November 23rd at the Grand Spa Hotel, Clifton, Bristol. Mr. P. E. B. Thomas, the company's branch manager, and Mrs. Thomas received the guests. During the evening many novelty dances were introduced, the winners being presented with gifts by Mrs. Thomas.

The male staff of the London office of Messrs. Crompton Parkinson, Ltd., and its associated companies, reinforced by contingents from the Chelmsford, Hayes and Edmonton works, held a smoking concert on Friday last at the Prince of Wales Hotel, Great Queen Street, S.W. About 150 people were present, including Mr. Frank Parkinson, the chairman of the company, and Mr. Holroyde, director.

On Saturday evening last the G.E.C. Apprentices' Association held their annual dance at the Magnet Club, Witton. This dance is their chief annual social function, and a tremendous amount of energy is always expended to ensure its success. The dance started at 7.30 p.m. and at 9.30 supper was served, during which a telegram was read from Dr. and Mrs. A. H. Railing, co-presidents of the Association, regretting their absence owing to Dr. Railing's indisposition. Among the guests were Mr. and Mrs. W. H. Heaton, Dr. and Mrs. C. C. Garrard, and Dr. and Mrs. Kahn.

New Scottish Electrode Works

We learn from our Glasgow correspondent that the Levernshields Works, Nitshill, Glasgow, have been acquired by the Sure-Arc Electrode Co., Ltd., for the manufacture of welding electrodes. Up to the present the company has been making electrodes in Aberdeen, and it has stores and offices in Newcastle, Manchester, Birmingham and London. The works at Nitshill have been equipped with new machinery. The Scottish Asbestos Co., Ltd., carries on the manufacture of asbestos at Levernshields works, and this activity is to be maintained alongside the new manufacture.

Electrical Propaganda in the Isle of Man

A series of demonstrations organised by the Isle of Man Electricity Board were commenced at Ramsey on November 20th and are continuing in various parts of the Island for a month. Last week Peel was the venue, and the remainder of the four weeks will be occupied at Port Erin, Port St. Mary, and Castletown. The cooking demonstrations at Ramsey were attended by 650 ladies and senior school girls.

Trolley Bus Construction in Belgium

The Société de la Fabrique Nationale d'Armes (F.N.), of Herstal, Liége, a concern which hitherto has devoted its automobile factory mainly to the production of motor cycles and cars, announces, in its annual report for the financial year 1933-34, that it has now taken up the construction of electric trolley-buses.

New Electricity Showrooms

The Watford Town Council has received the Electricity Commissioners' approval in principle to the proposal to erect electricity showrooms, and their consent to the application of a sum not exceeding £15,000 from the net surplus towards the cost of the showrooms. The Commissioners also state that they will be prepared to consider sanction to a loan required in addition to the £15,000.

The North-Eastern Electric Supply Co., Ltd., has opened new showrooms at East Boldon, near Sunderland. They are to act as an information bureau for Boldon, Whitburn, Fulwell and other surrounding villages.

The Torquay Electrical Exhibition

The fourth annual electrical exhibition at Torquay was opened on November 26th by the Mayor (Councillor A. L. J. d'Espiney). The exhibitors were as follows: Santon, Ltd.;

The Torquay Corporation Electricity Department's stand at the electrical exhibition held last week at Torquay

A. Harris & Son; Aidas Electric, Ltd.; General Electric Co., Ltd.; Torquay Co-operative Society, Ltd.; C. Buswell & Sons, Ltd.; Edwin Lee; Union Cable Co., Ltd.; S. J. Searle, Ltd.; Bastian & Allen, Ltd.; L. G. Hawkins & Co., Ltd.; S. Truscott, Ltd.; Bulpitt & Sons, Ltd.; Drury & Chaffe; Torquay Electricity Department; British National Electrics, Ltd.; Devon Elec. and General Services, Ltd.; Bathes, Ltd.; W. T. Clarke; and British Thomson-Houston Co., Ltd. The total attendance during six days was 16,400. Cooking demonstrations were given in an adjoining room by Miss Weedon, of the Jackson Electric Stove Co., Ltd., the attendance being 850. A home-cinematograph entertainment was given three times daily in the balcony, and the total attendance at this feature exceeded 2,500. E.D.A. and other electrical films were shown. The accompanying photograph shows the Electricity Department's stand, an "action" film of which was taken. It is intended that this film shall be enlarged to include other sections of the exhibition and electrical features and used for propaganda purposes. A lucky number competition was held during the exhibition, prizes being awarded each day by well-known electrical firms to the holders of programmes bearing winning numbers. The usual dance was held on November 30th and was attended by 250 guests. It was organised by the Electricity Department social section, and all exhibitors were invited.

For Sale

The West Central Merchandise Mart will sell by auction on December 18th the stock of Unity Electrical Accessories, Ltd., electrical factors.

(See our classified advertisements.)

Trade Announcements

Messrs. J. D. Morrison & Co., 10, Whitworth Street West, Manchester, have been appointed agents for Northern England and North Wales for British Electric Domestic Appliances, Ltd.

The Wessex Engineering Co., Ltd., has opened new premises at Sipson, Middlesex.

Mining Engineers to Move

The secretary of the Institution of Mining Engineers informs us that the Institute is removing from Cleveland House to Salisbury House, Finsbury Circus, E.C.2, during the second week in December.

Radio Apparatus in Latvia

It is reported from Riga that the State-owned electrical works in Riga has considerably developed its production in recent years, especially in radio apparatus. The import policy pursued renders it practically impossible for foreign makers to compete with the State works and other producers. The deliveries of the State works now supplies about 90 per cent. of the radio apparatus required by the country. Importers of foreign subsidiary parts have to possess a special licence as well as the usual trading licence. The imports of complete radio sets has been forbidden for some years past, as well as

loud speakers, transformers, condensers, etc. But the importation of radio valves, resistances and electrolytic condensers is permitted.

Ice Rink Lighting

In our last issue we incorrectly stated that the flood lanterns for lighting the ice rink at Streatham were made by

The final assembly shop of the G.E.C. radio battery factory at Witton, Birmingham

Philips Lamps, Ltd. The seventy-six flood lanterns installed were made by Messrs. Davis Bros., illuminating engineers, who were responsible for the whole of the installation, the lamps only being supplied by Philips Lamps, Ltd.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances.

CHEMICALS, ETC.	Price, December 5th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£40	—
a Ammonia, Muriate (large crystal) ... ,,	£38	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£19 15s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¾d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac T.N. ... ... per cwt.	£4 18s.	—
a Sulphur Commercial... ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a ,, Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. net.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil... ... ,,	1/2 to 2/9	—
p Babbits Metal and Anti friction Metals—		
Grade I ... ... per ton net	£206	—
Grade II ... ... ,,	£141	—
Grade III ... ... ,,	£69	—
c Brass (rolled metal 2" to 12" basis)... per lb.	6¾d.	—
c ,, Tubes (solid drawn) ... ... ,,	8¼d. to 9d.	—
c ,, Wire, basis ... ... ,,	7d.	¼d. dec.
c Copper Tubes (solid drawn)... ... ,,	9¼d.	—
g ,, Bars (best selected)... ... per ton	£58	—
g ,, Sheet ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£30 10s.	—
g ,, ,, Sheets ... ,,	£30 to £30 10s.	2s. 6d. to 10s.
d ,, ,, Wire Rods ... ,,	£35 10s.	— [dec.
d ,, ,, H.C. Wire ... per lb.	6¾d.	—
f Ebonite Rod ... ... ,,	1/6 to 2/– plus	—
,, Sheet ... ... ,,	1/3 to 1/6 *f* 10%	—
n German Silver Wire ... ... ,,	2/5	—
k Gutta-percha, fine ... ... ,,	nom.	—
k India-rubber, Para fine ... ... ,,	5¼d.	—
i Iron, Pig (Cleveland No. 3) ... per ton	62/6	—
i ,, Wire galv. No. 1, P.O. qual.... ,,	£20	—
g Lead, English Pig ... ... ,,	£12 10s.	—
g Mercury ... ... per bot.	£11/10 to £11/12/6	2s. 6d. dec.
c Mica (in original cases) small ... per lb.	6d. to 3/6	—
e ,, ,, medium ... ,,	4/- to 8/-	—
e ,, ,, large ... ,,	8/6 to 17/6 & up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	10¾d.	—
p ,, ,, rolled strip & Sheet ,,	10¼d.	—
p ,, ,, wire ... ... ,,	11¼d.	¼d. dec.
o Platinum ... ... per oz.	£7 15s.	—
d Silicium Bronze Wire ... ... per lb.	7 7/8d.	—
r Steel, magnet, in bars ... ... ,,	7¾d.	—
g Tin, Block (English) ... ... per ton	£228 10s. to £230 10s.	5s. dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	5/8	—

Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew Ltd.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead and rubber, up to the time of going to press, are given in our "Business Notes" under the same heading.

Credit for Contractors

"More Work for the Builder and Contractor" is the title of a booklet issued by the United Dominions Trust, Ltd., containing particulars of the financial facilities that are offered to those who need credit to assist them in carrying out their schemes and work.

Christmas Literature

The Christmas Number of *Electrical Housekeeping*, issued by E.D.A., contains a Christmas story by Marjorie Bowen, and an article on "Human Radio" by Oscar E. Millard; also illustrated particulars of a number of electrical novelties which are recommended as presents, and matter regarding electrical beauty aids.

Change of Name

The name of the Ever Ready Gramophone & Wireless Co., Ltd., has been changed to Ever Ready Radio, Ltd.

Local Exhibitions

The Poplar Borough Council Electricity Committee has recommended that an exhibition and demonstration of electrical domestic apparatus shall be held in conjunction with the General Electric Co., Ltd., at the East India Hall from January 22nd to 24th next.

The manager of the East Cornwall Electricity Supply Co., Ltd., Mr. J. H. Dent, was in charge of a display of electrical domestic appliances which formed part of demonstrations which took place at the Masonic Hall, Saltash, on November 29th. The demonstrations, at which useful hints in cooking were given, followed a similar series earlier in the week at Torpoint, and are the forerunners of others which are arranged to take place elsewhere in the district in the New Year.

Winding-up Order

In the Companies' Court on Monday last Mr. Justice Ev had before him a petition by the British N.S.F. Co., Ltd. Croydon, for the compulsory winding-up of Telsen Electric Co., Ltd. Mr. Buckmaster said the petition was before the Court on November 19th and stood over for fourteen days with a view to a scheme being prepared. Nothing having been done he asked for a compulsory order. Counsel for the company said that no arrangement had proved possible and under these circumstances the company supported the order. Counsel for creditors for £7,000 who opposed the petition did not now continue their resistance. His Lordship made a compulsory order and the usual order as to costs.

New Catalogues and Lists

W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1, have issued a set of six blotters showing the stages in the production of plyboards; a booklet describing box type units for overground disconnecting boxes (with sketches); the third edition of the jointing booklet (U.D.A.); and a catalogue of outdoor inverted terminal boxes; a leaflet on "Henleflex" and a booklet on t.r.s. cables and flexible cords.

Premier Electric Heaters, Ltd., Keeley Street, Birmingham 9.—A handsome catalogue of electric heating appliances covering fires, irons, kettles, hotplates, &c.. Fully illustrated and priced.

Dominion Electrical Co., 31, Windmill Street, Tottenham Court Road, W.1.—Leaflets on the "Lite-on" lampholder and griller.

L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, W.C.2.—A catalogue of "Supreme" electric clocks.

British Home & Office Telephone Co., Ltd., 272-274, Vauxhall Bridge Road, S.W.1.—A leaflet on the B.H.O.T. telephone.

J. H. Holmes & Co., Ltd., Hebburn-on-Tyne.—Particulars of Holmes-Reyrolle pedestrian-operated signals.

Richard Crittall & Co., Ltd., 43, Bloomsbury Square, W.C.1.—A booklet entitled "Heating by Electricity in the Modern Building."

Electro-Dynamic Construction Co., Ltd., Devonshire Grove, S.E.15.—Catalogues on rotary convertors for radio, &c.; a midget battery charger for d.c.; and power for public address.

Sun Electrical Co., Ltd., 118, Charing Cross Road, W.C.2.—A catalogue of "Sunco" domestic apparatus giving revised prices.

British Thomson-Houston Co., Ltd., Rugby.—A leaflet on the "Safety First" handlamp transformer.

Hotpoint Electric Appliance Co., Ltd., 24, Newman Street, W.1.—A leaflet on appliances suitable for Christmas presents and a special greeting label.

J. A. Crabtree & Co., Ltd., Lincoln Works, Walsall.—A catalogue of d.p. and s.p. "Compact" switch-sockets.

Bullers, Ltd., 6, Laurence Pountney Hill, E.C.4.—A new catalogue on pin-type insulators and spindles.

J. H. Sankey & Sons, Ltd., The Hill, Ilford.—A catalogue of "Pyruma" fire cement.

Typerlite Company, 86, Cannon Street, E.C.4.—A leaflet on "Typerlite" fittings.

G. Cohen, Sons & Co., Ltd., 600, Commercial Road, E.14.—A catalogue of modern second-hand plant and machinery.

Drayton Regulator & Instrument Co., Ltd., West Drayton.—A leaflet dealing with a new thermostatic room switch.

M. & C. Switchgear, Ltd., Kelvinside Works, Kirkintilloch, Glasgow.—Particulars of oil circuit-breaker gear.

Electrical & Auto Products (1931), Ltd., 280, Deansgate, Manchester, 3.—A leaflet on the "Runbaken" overnight battery charger.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, E.C.4.—A catalogue of primary cells and batteries.

Private Arrangements

J. D. Pont, 206, Stanley Road, Bootle, Liverpool, electrical engineer.—At a recent meeting of creditors a statement of affairs was presented which showed liabilities of £616 with net assets of £283, leaving a deficiency of £332. The principal assets were work in progress £62 and book debts £245, es

pected to produce £200. The debtor commenced business about six years ago as an electrical engineer at his present address. His present position was attributed to losses sustained on contracts and on transactions with a firm of lamp manufacturers. The debtor stated that he had to guarantee the due payment on all debts incurred on the sales of lamps and the expenses of running the agency were more than the commission obtained. He was desirous of continuing the business and it was decided that he should be allowed time in which to submit a guaranteed offer of 7s. 6d. in the £, payable as to 3s. 6d. on January 1st, 2s. on March 1st, and 2s. on June 1st, 1935. A committee was also appointed consisting of the representatives of Messrs. Falk, Stadelman & Co., Dodd & Oulton, Ltd., and G. P. Dennis, Ltd. It was further decided that failing a satisfactory offer being submitted a deed of assignment should be executed.

Bankruptcy Proceedings

Marcus Fisher & Co., wireless, &c., manufacturers and dealers, 9, Fitzroy Square, W.—The debtors, Marcus Fisher and Joseph Fisher, attended on November 28th at the London Bankruptcy Court for public examination upon accounts showing total liabilities of £11,725 (ranking £7,872) and net assets £5,344, after deducting £101 for payment of the preferential claims. They attributed the insolvency of the partnership to losses by bad debts; their liquid capital having been insufficient to carry on business of the magnitude of theirs; decline in the demand for gramophones; depreciation in the value of stocks owing to the constant improvement in wireless models; keen competition, and heavy overhead charges. The examination was concluded.

C. E. Keates, electrical engineer, Brent Street, Hendon.—This debtor appeared for his public examination at the London Bankruptcy Court on November 29th before Mr. Registrar Warmington. The accounts showed total liabilities of £3,845 (ranking £3,095) and assets valued at £1,110. The debtor said he began business in January, 1919, with £30 capital. During the following year he was joined by a partner and they traded as Keates & Lewis, but the partnership ceased in 1924, and he then recommenced business by himself at Brent Street. In 1929 he was absent from business through ill-health; the business declined and was closed down last March. In June he assigned the assets to a limited company for £695, payable by instalments. At first he acted as director of the company but resigned that office and was now employed as works manager. The debtor attributed his failure to bad trade, heavy overhead expenses, and ill-health. The examination was concluded.

E. W. G. Barge, 2, Oxford Road, Bournemouth, electrical engineer.—The public examination was held at Bournemouth on November 27th. The statement of affairs showed ranking liabilities of £284 and assets of £11, leaving a deficiency of £273. Debtor said he commenced business as an electrician at premises in Gervis Road in June, 1921, and after twelve months removed to Oxford Road. The business included the repairing of electrical plant and the wiring of houses. The failure was attributed to insufficient trade, running expenses of a motor car, and keen competition. The examination was formally adjourned.

T. J. Coleman, electrician, 22, Midland Terrace, Willesden Junction, N.W.10.—Receiving order made November 27th on debtor's own petition. First meeting December 10th and public examination February 13th, both at Bankruptcy Buildings, Carey Street, W.C.

J. H. Read, trading as "Read Bros," 100, High Street, Erdington, Birmingham, electrical engineer.—The first meeting of creditors was held on November 30th at the Official Receiver's Office, 159, Great Charles Street, Birmingham. It was reported that the gross liabilities amounted to £1,559, and there was a deficiency of £964. The failure was attributed to insufficient capital, depreciation in the value of wireless stock, bad trade, and pressure by creditors. The matter was left in the hands of the Official Receiver as trustee.

J. H. Peacock, wireless retailer, Cornmarket, Pontefract.—Last day for receiving proofs for dividend December 15th. Trustee, Mr. B. S. Briggs, 13, Burton Street, Wakefield, Official Receiver.

J. D. Drury (Mersey Electrics and Drury Bros.), electrical engineers, 64, Brasenose Road, Bootle, near Liverpool.—Trustee, Mr. C. Semper, National Bank Buildings, Fenwick Street, Liverpool, released November 12th.

D. J. Watkins (Watkins & Son), wireless and electrical engineer, 72, Victoria Road, Surbiton.—Last day for receiving proofs for dividend December 11th. Trustee, Mr. C. R. Waterer, 29, Russell Square, W.C., Official Receiver.

R. C. Stevens, wireless dealer, The Green, Billingham.—Last day for receiving proofs for dividend December 12th. Trustee, Mr. C. L. Townsend, 80, High Street, Stockton-on-Tees, Official Receiver.

H. N. Wicks, electrical specialist, Railway Hotel Buildings, Greenhithe.—Last day for receipt of proofs for dividend December 15th. Trustee, Mr. F. H. Langmaid, Official Receiver, 230a, High Street, Rochester.

I. L. Lawrence, electrician, 11, Grand Parade, Brighton.—First and final dividend of 2s. 9¾d. in the £, payable November 30th at 8, Old Steine, Brighton.

Company Liquidations

Great West Electrical Co., Ltd., Metro Works, Brentford, Middlesex.—The statutory meeting of creditors was held recently at the offices of Messrs. Greenhalgh, Sharp & Co., I.A., 11, Waterloo Place, Pall Mall, S.W.1, when a statement of affairs was submitted showing liabilities of £578, of which £545 was due to sundry creditors; there were cash creditors for £92. In addition there were fully secured creditors for £94, holding security valued at a like amount. The net assets were £338, leaving a deficiency of £251. The company was incorporated in 1931, with a nominal capital of £1,000, of which £900 was issued. The creditors resolved to confirm the voluntary liquidation of the company with Mr. W. H. Sharpe as liquidator, together with a committee of inspection consisting of the representatives of the Sun Electrical Co., Ltd., the Simplex Electric Co., Ltd., and Mr. Jackson.

Economic Household Appliance Co., Ltd.—Winding up voluntarily. Liquidator, Mr. A. W. Hardwick.

Clear Radio, Ltd.—Meeting January 21st at Bush House, Aldwych, W.C., to receive an account of the winding-up by the liquidator, Mr. H. G. Howell.

East Sussex Wiring Co., Ltd.—Meeting December 31st at 46-7, New Broad Street, E.C., to receive an account of the winding-up by the liquidator, Mr. D. Robertson.

Riddle & Goddard, Ltd.—Meetings December 31st at 157, Rushey Green, Catford, to receive an account of the winding-up by the liquidator, Mr. H. S. Hardwick.

Clifford & Snell, Ltd.—Last day for receiving proofs for dividend December 12th. Liquidator, Mr. E. T. A. Phillips, 33, Carey Street, W.C., Senior Official Receiver and Liquidator.

Dissolution of Partnership

Hazel Grove Radio Service, radio engineers and dealers, 171, London Road, Hazel Grove.—Messrs. J. J. Cookson and H. Goostrey have dissolved partnership. Mr Goostrey will attend to debts and carry on the business.

The "Goods Train" of the Air. By John C. Hancock

TO-MORROW, Saturday, sees the opening of the new Imperial Airways weekly service to Australia. Twelve days later mails and a limited amount of freight will be landed in Brisbane ready for delivery before Christmas. It is hoped to open the service for passenger traffic early in the new year.

Only the other day Lord Londonderry announced in the House of Lords what was already known in well-informed aviation circles, that the extension of the existing Singapore air route as far as Australia had been contemplated some months before the Melbourne air race.

When flying was in its infancy, manufacturers naturally hesitated to send their goods by air. They are gradually overcoming this tendency, for experience shows that the conveyance of goods or passengers by aeroplane is as safe as by any other means of transport. The saving in time is considerable; in most cases the time factor is reduced by as much as three-fourths. Moreover, there are no Belisha beacons or traffic lights to say "stop" and "go" when the machine is in flight. Such delays are unknown in the air.

Unlimited air travel is allowed in most life insurance policies, while the rates of insurance for goods carried by air are generally lower than the surface-transport rates. Goods sent by air are handled with the greatest of care and breakages of fragile articles seldom occur. Quantities of bullion pass between this country and the Continent nearly every week.

Air transport is particularly suitable for the conveyance of electrical equipment and accessories, to say nothing of valuable and delicate instruments. Even if the cost by air is ten times greater than the cost of sea freight on occasions it definitely pays the manufacturer to send his goods by aeroplane. Perhaps one of his staff engineers, away on a foreign contract, is being held up by the unexpected need of a particular item of equipment which he is unable to obtain on the spot. An urgent call goes out. He receives the necessary item by air in a week instead of the usual three or four weeks—and the contract is completed on time. Or perhaps a customer urgently wants some electrical device. It arrives, by air, a fortnight quicker than he had hoped. If he is fair-minded—and most people are—he is not likely to forget his supplier when placing larger and perhaps less urgent orders. When sending their technicians or salesmen abroad, electrical contractors or engineers cannot afford to ignore the many air routes at their service.

For some years regular air services have been operating from this country to East Africa and the Cape, to India and Singapore, to say nothing of the daily services to the Continent. Apart from fog, the weather is never so bad as to interfere with the regularity of these services. The manufacturer, by the way, can always charter a 'plane to convey his staff or goods when no regular air service is in operation.

England has certainly a record to be proud of as far as safety in aircraft is concerned. The safety factor is predominant in British civil aviation policy. On long-distance routes, such as the new England-Australia service, the route is divided into sections. Each section is flown over by a different machine piloted by a man familiar with local flying conditions and comfort for passengers is a reality.

The chess player by thinking two moves ahead of his opponent is able to beat him. The manufacturer of to-day must be equally capable of thinking ahead of his opponents in the sphere of business. Transport by air is the freight service of the future, and the manufacturer who uses it to-day on all possible occasions is but thinking in advance of his competitors.

Electricity Supply

Lighting, Domestic, Power

Aberdeen.—CONCESSION TO POWER CONSUMERS.—Certain large power consumers who take supplies under agreement for a term of years are to have their charges reduced, according to a decision of the Electricity Committee.

MAINS EXTENSION.—An extension of mains in various streets of the town and district has been authorised. The cost is £2,976.

Ashton-under-Lyne.—ILLUMINATIONS.—Since it has been decided to floodlight various public buildings in the town, as a Christmas attraction, the Chamber of Trade has received many inquiries from other industrial towns asking for particulars of the scheme. A series of illuminations is to be held between December 8th and 31st. One of the news-reel film companies has announced its intention of photographing the illuminations, which will be included in a film to be shown at over 200 picture cinemas.

Bedford.—A COMMENDABLE ACHIEVEMENT.—It was reported to the Town Council that 80 per cent. of the inhabitants of the area now have electricity supplies.

Biggleswade.—SUPPLY EXTENSION.—The Urban District Council is to inquire whether the First Garden City, Ltd., is prepared to pay for the extension of mains to supply electricity to forty houses at the Dells, and also if the tenants are prepared to make weekly contributions towards the cost of the installation.

Blackburn.—REDUCED CHARGES.—Among other concessions, the Electricity Committee has decided to reduce the price of electricity for lighting from 6½d. to 6d. per kWh. The reductions represent £9,493 a year (£7,143, lighting flat rate; £1,850, "all-in" tariff for commercial premises; and £500, cinemas and theatres).

Blofield.—VILLAGE SUPPLIES.—Norwich and Great Yarmouth Corporations have communicated with the Rural District Council with regard to complaints received of the lack of electricity supplies in various villages, and have asked for the names of the villages in order that they may consider the circumstances.

Bolton.—BUSINESS CHARGE.—The Chamber of Trade is pressing for lower electricity charges for business premises. A deputation recently interviewed the electrical engineer and urgd him to adopt the Electricity Commissioners' recommendation to institute a fixed charge and a low running charge. This concession has been granted, the "unit" charge being ¾d., but the Chamber complain that the fixed charge is so large as to be practically prohibitive, and to increase rather than reduce the total bill in many cases.

Bradford.—MAINS EXTENSIONS.—The Electricity Committee has approved mains extensions in the city (£4,500) which are expected to yield a yearly revenue of about £1,000.

Campbeltown.—SUPPLY NEGOTIATIONS.—The Town Council recently decided to oppose the inclusion of the town within the scope of an Order to supply electricity in an area extending from Lochgilphead, in Mid-Argyll, to Southend, in Kintyre, and it is now reported to be endeavouring to come to terms with Messrs. Johnson & Phillips, who carried out the installation in Dunoon.

Carlisle.—EXTENSION PROJECTS.—The Electricity Committee has recommended the supplying of electricity to Cocklakes (£568), Tindale (£908) and Midgeholme (£1,311).

CATHEDRAL FLOODLIGHTING.—A scheme for floodlighting the Cathedral has been approved.

Chesterfield.—REQUEST FOR ELECTRICITY.—Residents in Hasland and Winsick propose to ask the Corporation Electricity Department for supplies.

INQUIRY.—The Electricity Commissioners are holding an inquiry into the application of the Corporation to borrow £65,500 for extension of the generating station.

Chester-le-Street.—PURCHASE OF UNDERTAKING OFFER.—The Council has received an offer from the North-Eastern Electric Supply Co., Ltd., to discuss terms for taking over the electricity undertaking.

Chidham (Sussex).—A SUPPLY PROMISED.—The Portsmouth Corporation is to erect overhead lines to supply electricity to Chidham. The Chichester Rural District Council is to ascertain whether any of the tenants of Council houses want supplies, and, if so, is to invite tenders for wiring the houses.

Cranbrook.—RURAL DEVELOPMENT.—The Rural District Council has consented to the erection of overhead lines from Pullington to Ramsden, Benenden, by the Weald Electricity Supply Co., Ltd., which is also to lay e.h.v. underground cables at Frittenden, Staplehurst and Headcorn, a distance of 7,380 yards.

Croydon.—IMPROVED STREET LIGHTING.—The Electricity Committee recommends that the lighting of certain streets shall be improved (£784).

SWIMMING POOL.—A supply is to be provided to swimming pool and club premises to be erected at Birchanger Road, South Norwood. A new sub-station will be needed, and this is to be erected by the club proprietor.

Cumnock.—SUGGESTED ALL-ELECTRIC HOUSES.—At an electric cookery demonstration held by the General Electric Co. the company's representatives suggested that the Council should construct all-electric houses in their next scheme. It was claimed that by this means £3,000 could be saved in the capital cost of 166 houses, as chimneys and grates would not need to be built. The matter is to be remitted to the Housing Sub-Committee, with powers to arrange deputations to other schemes and instructions to present a complete report at the earliest possible date.

Durham.—SCHOOL INSTALLATION.—The County Education Committee has secured consent to the installation of electric lighting at the Page Bank Council School.

Earby.—APPEAL TO CONSUMERS.—An appeal has been made for electricity consumers to co-operate with the Council in limiting the "maximum demand" to the lowest possible figure during December as the sales for the month will largely determine the bulk price of electricity.

Eastbourne.—REVISED TARIFF.—The Electricity Committee has adopted a minimum fixed charge for all-electric or coal-electric houses of £3 per annum.

LOAN.—Sanction has been obtained to a loan of £17,000 for consumers' apparatus.

Edinburgh.—NEW ASH-CONVEYING SYSTEM.—The city architect and the engineer and manager of the Electricity Department recommend that provision be made in the Corporation's Provisional Order for borrowing powers to include a new ash-conveying system at the power station. The new system, which includes ash-suction pipes, would eliminate the dissemination of ash dust. The original estimated cost of the work in connection with the new chimney would be increased by about £10,000. The matter has been remitted to the Electricity Sub-Committee for consideration.

Falkirk.—TRANSFORMERS.—The Electricity Committee is to have installed at the Manor Street sub-station two new 1,000-kW transformers costing £500 each.

Findhorn (Morayshire).—SUPPLY PROPOSAL.—If sufficient support is forthcoming, the Grampian Electricity Supply Co. is to provide a branch service to Findhorn from the line between Forres and the new B.B.C. broadcasting station at Burghead.

Folkestone.—PARLIAMENTARY BILL.—The Folkestone Electricity Supply Co. has applied for a Bill to revoke the 1896 Electric Lighting Order, to give new powers to the Corporation for purchasing the electricity undertaking, and to confer various powers on the company.

Frinton and Walton.—RIGHT TO PURCHASE.—The Urban District Council is recommended not to exercise its right to purchase the electricity undertaking in 1937 on the understanding that the Electricity Co. will install new machinery, extend the mains, and reduce the charges.

Glasgow.—INCREASED COAL CHARGES.—The Electricity Sub-Committee has decided to enter into contracts for coal at 14s. per ton, compared with 11s. 9d. last year. The Department is to contract for the supply of 300,000 tons, and the cost will exceed that of last year by £30,000.

LOCH KATRINE HOUSES.—The Water Committee recommends that an electric lighting plant, consisting of a generator driven by a Diesel oil engine and battery of accumulators (£400), be installed for the electrification of houses, &c., at Loch Katrine (the source of the city's water supply).

Glossop.—UNDERTAKING NOT TO BE SOLD.—The Town Council has decided not to exercise its option of purchasing the electricity undertaking. The lighting flat rate has been reduced to 7d. per kWh as from the end of last September.

Guildford.—ELECTRIC HEATING AT SCHOOL.—The Education Committee is considering the installation of electric heating at the new senior girls' school for the northern area.

Halifax.—PROGRESS.—Particulars of the electricity undertaking's progress have been sent to us by Mr. G. A. Vowles, showing that new services installed from April 1st to November 17th, 1933, were 1,022, whereas during the same period this year the figure is 1,351, an increase of 32 per cent., the average weekly connections increasing from thirty-three to forty-one. New cookers installed last month totalled 160, as compared with ninety-two during October, 1933; washboilers and additional apparatus also showed an increase of 70 per cent. and 69 per cent. for October. During the month there was a net increase of 19.5 per cent. in the amount of electricity sold for domestic and power purposes.

OUTER AREA CONCESSION.—It is proposed to abolish the additional charge of 15 per cent. for electricity supplied outside the borough which has operated since 1922.

Horsham.—SUPPLY EXTENSION.—The Urban District Council is to extend the cables to supply houses on the Jews Meadow (£2,500), and the Electricity Commissioners are to be approached with respect to giving a supply to Slinfold.

Kent.—ELECTRICITY IN INSTITUTIONS.—The Public Assistance Committee recommends the installation of electricity at Milton Institution (£375) and in part of the Coxheath Institution (£450).

Kidsgrove.—SUPPLY INAUGURATED.—A supply of electricity has been provided by the North-West Midlands J.E.A. Other

parts of the district are also to be supplied, and the Authority has recently approved a scheme for furnishing Harrieshead with electricity at a cost of £1,600.

Kilwinning.—PETITION FOR ELECTRICITY.—Tenants of the three municipal housing schemes have petitioned the Town Council for the installation of electric light in place of the existing gas lighting.

Kincardine.—DEVELOPMENTS ON DEESIDE.—Kincardine o' Neil, on the banks of the Dee, is the first village in Aberdeenshire to be lighted by electricity under the Grampian electricity supply scheme. The final connections were made on November 28th. At a meeting of the Kincardineshire Education Committee the Grampian Electricity Supply Co. confirmed an offer of an extension line to include Laurencekirk School. A rate of 2s. 9d. per quarter per 100 W installed, plus ¾d. per kWh consumed, was recommended under a comprehensive agreement for the supply of electricity to schools within reasonable reach of the l.v. main.

Lanarkshire.—NEW CABLES.—The County Road Board has approved the Clyde Valley Electrical Supply Co.'s scheme to lay new cables in ten districts. This scheme is part of the Clyde Valley Co.'s plans to replace existing cables and to inroduce electricity to many villages at present lighted by gas.

London.—FULHAM.—The Electricity Committee is seeking sanction to borrow £10,000 for rental-wiring installations.

ST. PANCRAS.—The Electricity Committee is to extend mains (£568).

POPLAR.—The Electricity Committee recommends that sanction be obtained to borrow £5,000 for sub-station equipment.

Manchester.—POWER CHARGES.—A meeting took place last week between a committee of the Federation of Master Cotton Spinners' Associations and representatives of various electrical undertakings in Lancashire on the question of charges for electricity used for driving machinery in cotton mills. The object of the meeting was to secure an all-round reduction in the charges and also uniformity among the undertakings.

Merthyr (Glam).—PROPOSED TRANSFER OF UNDERTAKING.—The Corporation intends to apply to the Electricity Commissioners for permission to acquire the electricity undertaking of the Merthyr Electric Traction & Lighting Co., Ltd. This action is being taken on the recommendation of a sub-committee, and is made under the Merthyr Tydfil Electric Lighting Order, 1899.

Northern Ireland.—BELFAST.—The primary transmission scheme for the distribution of electricity at the Harbour power station, Belfast, has been inaugurated. The scheme will cost nearly £100,000. Already £40,000 has been expended on the first portion of it.

Oxford.—RECENT PROGRESS.—The Electricity Committee reports that the results of the first year's development programme following the completion of the major part of the change-over are so striking and encouraging that it has instructed the engineer to prepare statistics for the information of the Council. A great deal of credit is due to the efforts of local contractors to popularise the extended use of electricity, and for their services in this direction, together with change-over work, the Corporation has paid them £26,492. The following figures relate to the 1890 Order only, and show the improvement during the last two years: Consumers connected at December 31st, 1931 (date of taking over the undertaking), 5,776; at September 30th, 1933, 7,485; and at October 31st, 1934, 11,120. Cookers installed at September 30th, 1933, 64; and at October 31st, 1934, 1,261. Water heaters installed at September 30th, 1933, 28; and at October 31st, 1934, 436. Wash-boilers installed at October 31st, 1934, 197. Assisted-wiring consumers connected at October 31st, 1934, 2,462. The amount of electricity sold for the six months ended September 30th, 1934, was 4,290,936 kWh, an increase of 50½ per cent. over the similar period for 1933.

Revo lighting standards in Carlton Road, Oxford

SUB-STATION.—The Oxford Electric Co., Ltd., is to erect a sub-station at Cinnaminta Road, Oxford.

Petersfield.—LISS STREET LIGHTING.—The Rural District Council is negotiating with the Mid-Southern Utility Co. with regard to estimates for street lighting at Liss.

Portland.—REDUCED CHARGES.—The Weymouth Corporation has notified the Urban District Council of its intention to reduce the "unit" charge to that Council from 7d. to 5d.

Potters Bar.—STREET LIGHTING.—An agreement has been concluded between the Urban District Council and the Northmet Co. with regard to a public-lighting scheme.

Retford.—TARIFF FOR NEW AREA.—The Town Council is to extend the supply of electricity to Sturton-le-Steeple by overhead lines, and the charge through an ordinary meter will be 8d. per kWh and by slot meter 8½d., with an alternative tariff of a fixed quarterly charge of £1 per 100 sq. ft. of floor space, plus 1½d. per kWh. Where premises are wired under the free-wiring scheme the "unit" charge will be 10d., and for power there will be a flat rate of 4d. per kWh, or a fixed charge based on the capacity of the plant, plus 1½d. per kWh.

Ripon.—RURAL DEVELOPMENT.—Harrogate Corporation has sought the consent of the Ripon Rural District Council to its application to the Electricity Commissioners for permission to supply electricity in the rural district of Ripon. In giving this the Council has decided to ask Harrogate to cancel the meter rents and other additional charges.

Seaham Harbour.—LOAN.—The Electricity Committee has obtained sanction to borrow £1,000 for a hire-purchase scheme.

LOWER BULK-SUPPLY CHARGE.—The Urban District Council has been notified that the North-Eastern Electric Supply Co. intends to reduce the charge for street lighting from 0.7d. to 0.45d. for every kWh consumed over 1,250,000 per annum as from January 1st, 1935. The Council has decided to ask the company to make the reduction applicable from October 1st last.

HOUSE LIGHTING.—It was agreed that the clerk should communicate with Londonderry Collieries, Ltd., regarding their refusal to allow forty residents in colliery houses to have electric light installed.

Sheffield.—MAINS EXTENSIONS.—The Electricity Committee has approved expenditure on mains extensions amounting to £7,144.

Shillington.—PUBLIC LIGHTING.—A sub-committee has been appointed by the Parish Council to consider the question of electric street lighting for the village.

Shipley.—SUPPLY TO ESTATE.—The Electricity Committee has made arrangements to provide electricity supply to an estate at Car Top to be developed by the Wrose Hill Estates Co., Ltd. The Committee also agreed to provide an electricity supply to a new estate in Westfield Lane.

Stoke-on-Trent.—SUPPLY AT BLURTON.—The Electricity Committee has received an Order permitting it to supply premises in Trentham Road, Blurton, in the rural district of Stone.

SUPPLY EXTENSION.—A supply, costing £600, is to be provided to ninety-five houses and two shops to be erected at Hempstalls Lane, Wolstanton, by the Bourneville Village Trust, and to Messrs. G. Woolliscroft & Sons, Ltd., Etruria (£900); to Brook Street, Hanley (£300); and to the Goldendale Tileries, Ltd., Chatterley (£1,000).

Sunderland.—DISPUTE OVER RESERVE FUND.—Members of the Town Council have expressed opposition to a recommendation by the Electricity Committee that a reserve fund should be created for the electricity undertaking up to a maximum of one-tenth of the Council's capital expenditure on the undertaking. It was suggested that the reserve should be one-twentieth (£75,000), as in 1935 the whole of the generating plant would be taken over by the C.E.B., and the Board would then be responsible for all breakdowns in plant. The suggestion was defeated.

Surrey.—REWIRING HOSPITAL.—The County Council has instructed the consulting engineer, Mr. E. Lancaster Burne, to prepare a scheme for rewiring, &c., at the Kingston Hospital. Two lifts are also to be provided at a cost of £1,530.

Totnes.—A PETITION FROM WRANGATON.—The Rural District Council has received a petition from Wrangaton asking that Torquay Corporation should supply electricity to the area.

Walton-on-Thames.—TARIFF PROPOSALS.—The Electricity Committee is to report to the Urban District Council on the desirability of introducing a commercial heating and lighting tariff after the end of the present financial year. There is to be a special charge of 1d. per kWh for outside display lighting during the Christmas-shopping period.

Whitburn.—ELECTRICITY CHARGES.—At a meeting of the Town Council an offer was submitted from Scottish Midlands Electricity Supply, Ltd., regarding the installation of electricity in 200 houses about to be built. It was stated that for a consumption of 360 kWh per annum in a three-apartment house the offer worked out at 2s. 3d. per week, inclusive. The town clerk was instructed to ask the company to do away with the fixed charges and to give the cheapest flat rate. A reduction in tariffs with regard to all the housing schemes is also to be asked for.

Wigton (Cumberland).—OVERHEAD LINES.—The Rural District Council has decided not to object to the erection of overhead lines at Little Bampton, Kirkbampton, Oughterby, Kirkbride, and Newton Arlosh by the Mid-Cumberland Electricity Co., Ltd.

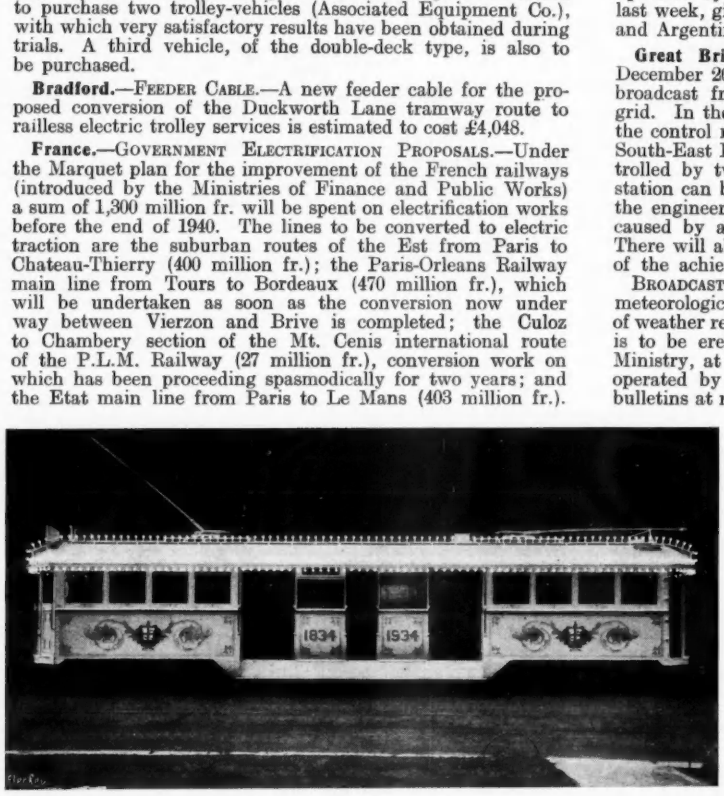
Worcester.—LOAN.—The Electricity Committee recommended the City Council to apply for a loan of £10,000 to finance a scheme for hiring electric cookers and water heaters.

Traction

Australia.—TROLLEY-VEHICLES.—The New South Wales Department of Road Transport and Tramways has decided to purchase two trolley-vehicles (Associated Equipment Co.), with which very satisfactory results have been obtained during trials. A third vehicle, of the double-deck type, is also to be purchased.

Bradford.—FEEDER CABLE.—A new feeder cable for the proposed conversion of the Duckworth Lane tramway route to railless electric trolley services is estimated to cost £4,048.

France.—GOVERNMENT ELECTRIFICATION PROPOSALS.—Under the Marquet plan for the improvement of the French railways (introduced by the Ministries of Finance and Public Works) a sum of 1,300 million fr. will be spent on electrification works before the end of 1940. The lines to be converted to electric traction are the suburban routes of the Est from Paris to Chateau-Thierry (400 million fr.); the Paris-Orleans Railway main line from Tours to Bordeaux (470 million fr.), which will be undertaken as soon as the conversion now under way between Vierzon and Brive is completed; the Culoz to Chambery section of the Mt. Cenis international route of the P.L.M. Railway (27 million fr.), conversion work on which has been proceeding spasmodically for two years; and the Etat main line from Paris to Le Mans (403 million fr.).



This tramcar, of attractive design and illuminated by over 1,000 lamps, appeared in connection with the Melbourne centenary celebrations. Crompton lamps were largely used for this as well as for the street decorations; they are also employed exclusively in "Joyland" a new £100,000 Melbourne amusement park, and in "Chevron," a palatial hotel recently opened

In addition, 195 million fr. will be spent on the erection of new h.p. transmission lines and in providing new interconnections in the Paris area.

Glasgow.—NEW TRAMWAY LINE.—The Transport Committee has approved proposals to lay a single line of tramway in Annan Street (£3,000).

Hull.—TROLLEY-BUS PROPOSAL.—It may shortly be necessary for the Transport Department to incur an expenditure of £30,000 on tram-track renewals, and the question of using trolley-buses instead of maintaining the tramways is being discussed.

Ipswich.—TROLLEY-VEHICLES.—The Corporation intends to apply to the Minister of Transport for a Provisional Order to run trolley-buses on several routes in the borough and in neighbouring parishes.

Manchester.—NEW TOWER WAGON.—A tower wagon which has recently been supplied to the electricity department has a superstructure mounted on a Commer "Centaur" 2-ton chassis with 10 ft. 6 in. wheelbase. The height when the tower is lowered and the platform guard rails are down is 11 ft. 3 in., and when fully extended 26 ft. The tower platform, which measures 4 ft. by 2 ft., is of the swivelling type. Winches with removable handles are provided, while a power take-off with a special reduction gear is fitted to enable the tower to be servo-operated. Four jacks are so arranged that they can be quickly lowered to the ground by means of hand-wheels.

Reading.—TROLLEY-BUS BILL.—The Town Council has decided to promote a Bill in Parliament to empower it to run trolley-buses as it intends to cease to operate the tramways.

Russia.—BATTERY VEHICLE.—A Russian transport works has constructed a new battery vehicle, we are informed by *Reuters' Trade Service*, Moscow. On the rear axle are placed two electric motors each of 2½ h.p., and on the chassis are two 160-Ah accumulator batteries. The speed is 20 kilometers an hour (about 12½ miles), and the vehicle has a capacity of 1¼ ton. The accumulators must be recharged every four working hours.

Traffic Signals.—Signals are to be installed at Bedford (£866); East Barnet; Everetts Corner, Cippenham; Johnstown, Carmarthen; and are to be considered by the Middlesex County Council for Acton, Brentford, Ealing, Enfield, Finchley, Hayes, Hendon, Heston, Sunbury, Tottenham, Wembley, Willesden, and Wood Green (£10,000).

Communications

Argentina.—CABLE SERVICE TO BRITAIN.—A new cable station operated by Cables & Wireless, Ltd., was opened at Rosario last week, giving direct communication between Great Britain and Argentina.

Great Britain.—THE WORK OF THE GRID.—On Tuesday, December 20th, from 8.15 to 8.45 p.m., a programme will be broadcast from the Regional stations on the work of the grid. In the course of the programme listeners will "visit" the control room at Bankside and hear how the power of the South-East England area, from Peterhead to Brighton, is controlled by two men. They will see how a breakdown at a station can be speedily dealt with, without anyone other than the engineer being aware of it, and how the extra demands caused by a fog approaching London can be prepared for. There will also be a glimpse into the future, visualising some of the achievements which may eventually be possible.

BROADCASTING WEATHER REPORTS.—A national aviation meteorological station, the programmes of which will consist of weather reports, weather forecasts, and warnings for airmen, is to be erected by the Marconi Co., on behalf of the Air Ministry, at Cranwell, Lincolnshire. This new station, to be operated by the Air Ministry, will transmit meteorological bulletins at regular intervals throughout the day. It will have an energy of 2 kW in the aerial, and will operate on the wavelength now used by Heston, which it will supersede, namely, 1,158 metres (253 kilocycles).

TELEPHONE PROGRESS.—There has been a large increase in the number of new telephone subscribers since the introduction of the lower rates on October 1st. Between that date and November 17th the increase was 73,500, whereas during September there was only a rise of 21,761. Some places show a greater increase during the seven weeks from October 1st to November 17th than during the previous six months; in Glasgow the increase was 128.5 per cent., followed by Liverpool, 113.2, and Edinburgh, 91 per cent. Aberdeen, Bristol, the North Midlands, and Newcastle-upon-Tyne all showed an increase of over 80 per cent. London's increase was 71.5 per cent., the development of the telephone service in the Metropolitan area, being already very high, compared with other towns.

Holland.—RADIO STATION TO CLOSE.—It has been decided to unify Dutch broadcasting by forming a limited liability company, which will erect a large central station at Hilversum, with both long- and short-wave transmitters. The present Huizen station will be closed.

Iceland.—LISTENERS.—At the end of September radio listeners numbered 9,357, an increase of 1,327 in the course of nine months.

India.—CEYLON TELEPHONE DEVELOPMENT.—Extension of the present exchange, purchase of more automatic equipment and apparatus, establishment of two sub-exchanges, a large increase in the number of lines, and the introduction of measured-rate charges instead of a flat rate are some of the features of the new scheme for the development of the Ceylon telephone service now receiving consideration by the Government.

BANGALORE LINK.—It is likely that provision will be made in the Government Budget for a direct telephone line between Bangalore and Madras. If this connection is established Bangalore will be included in the all-India trunk telephone system.

Newcastle-on-Tyne.—NEW TELEPHONE CABLE.—Work has been started by the Post Office on the laying of a new cable between Newcastle and Carlisle, a distance of 56 miles. Messrs. Siemens Bros. are carrying out the work.

Russia.—TELEVISION.—According to the *Wireless World*, the Soviet Radio Committee, in Moscow, which has been broadcasting television programmes for some time, now transmits them in the form of a "Telechronique" or television newspaper. The transmission is by means of specially prepared sound films.

Scotland.—TELEPHONY IN THE SHETLANDS.—Wireless telephonic communication between Lerwick and the Out Skerries, Shetland, was officially inaugurated on November 29th. The Out Skerries have hitherto been isolated from the mainland of Shetland. The service, which will be conducted through coastguards, will be a telegraphic one for the public, and it is hoped it will soon be extended to Papa Stour and Foula Islands.

Straits Settlements.—SINGAPORE.—According to a *British United Press* message from Singapore, a broadcasting station is to be built there. The General Electric Co., Ltd., and Standard Telephones & Cables, Ltd., are to establish this station with municipal aid.

West Sussex.—SCHOOL RADIO.—The County Council has approved a proposal to supply radio-receiving sets to selected schools in the county, and sets are to be installed immediately at Angmering, Bognor Regis Boys', Chichester Lancastrian Senior Girls' and Southwick Senior Girls' Schools.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Ashbourne.—December 21st. U.D.C. Two indoor sub-station equipments, two outdoor transformer sub-stations, one e.h.p. switch kiosk and one pole-mounting transformer. (See this issue.) E.h.p. overhead lines and underground cable, and l.p. overhead and underground distribution and roadwork. (November 30th.)

Australia.—SYDNEY.—Municipal Council. January 7th. Automatic boiler control equipment for three boilers at the Bunnerong power station. (A.Y. 12737.)*

January 14th. Supervisory control equipment for the remote control of switchgear and transformers in a 33-kV sub-station. (A.Y. 12764.)*

N.S.W. Department of Road Transport. January 28th. Traffic control equipment for nineteen street intersections. (A.Y. 12796.)*

MELBOURNE.—Posts and Telegraphs Department. January 29th. Ringing and tone equipment (vibratory type) and delayed alarm control equipment. (A.Y. 12771.)*

January 22nd. Telephone hand sets (A.Y. 12799)*. Telephone induction coils and registers (A.Y. 12802.)*

Beckenham.—December 17th. U.D.C. Electric cookers for period from January 31st next to March 31st, 1936. (November 30th.)

Bexhill.—December 21st. Electricity Department. One 300-kVA transformer, and conversion of d.c. wireless apparatus for a.c. supply. (See this issue.)

Bexley.—Electricity Department. One six-panel 22-kV switchboard and cabling. (November 30th.)

Birmingham.—January 3rd. Electric Supply Department. E.h.p. metal-clad sub-station switchgear, transformers and reactances, transformer oil and l.p. a.c. switchgear. (See this issue.)

Blackpool.—December 11th. Corporation. 6,600-V three-phase compound-filled metal-clad draw-out switchgear. (November 30th.)

December 19th. Electricity Department. 6,600-V overhead line (length 2,500 yd.). (See this issue.)

Bristol.—December 12th. Electricity Department. Five l.p. switchboards and five e.h.p. armour-clad compound-filled switch panels. (November 23rd.)

Bromley.—December 24th. Town Council. Vehicle-actuated traffic signals at Bromley Common, Holmesdale Road, and Hayes Lane junction. Particulars from the borough engineer.

Canada.—KENORA.—January 10th. Two electric motor-driven centrifugal pumping units. (G.Y. 14501.)*

Cannock.—December 17th. Electricity Department. Medium and e.h.p. cable and meters. (See this issue.)

Dorchester.—December 17th. Electricity Department. Supply and laying of p.i., l.c. steel-tape-armoured cable. (See this issue.)

Dorset.—December 17th. Public Assistance Committee. Electric lighting and fittings at the Institution, Sturminster Newton. Particulars from county architect, Dorchester.

Ealing.—December 14th. Electricity Department. 500-kVA, 11,000-V, 3-phase, 50-cycle transformers. (November 30th.)

Glasgow.—December 12th. Education Department. Electrical work at St. George's Road School. Specifications from Education Offices (Property Department), 129, Bath Street (deposit £1 1s.); tenders to town clerk.

Hastings.—January 31st. Electricity Department. Electrical materials for the year ending March 31st, 1936. (See this issue.)

Heston & Isleworth.—December 21st. Electricity Department. Distribution network pillars. (See this issue.)

Horsworth.—December 11th. U.D.C. Electrical recording apparatus for Scotland Lane waterworks. Particulars from J. E. Aldersley, waterworks engineer, Council Offices (deposit £2).

Lancaster.—Electricity Department. Medium pressure cables. (November 30th.)

London.—Metropolitan Water Board.—January 8th. Steam turbine with centrifugal pumps and electric generator for Hammersmith pumping station. Specifications, &c., from chief engineer on production of an official receipt for £2 2s., which must be deposited with the accountant to the Board; tenders to clerk of the Board, Offices of the Board, Room 122, 173, Rosebery Avenue, E.C.1.

Manchester.—December 10th. Electricity Department. Switchgear, piping, water valves, storage-type electric water heaters, immersion heaters and two electrically driven circulating water pumps. (November 30th.)

Morecambe & Heysham.—Electricity Department. Medium-pressure cables. (See this issue.)

Morocco.—RABAT.—December 27th. Posts and Telegraphs Department. Telephone cable. (A.Y. 12756.)*

Newton-in-Makerfield.—December 17th. Electricity Department. 400-kVA and 200-kVA transformers and 11-kV circuit-breaker. (November 23rd.)

New Zealand. — CHRISTCHURCH. — Electricity Department. January 15th. Metal-clad switchgear. (A.Y. 12723.)*

Drainage Board. April 5th. Three electrically driven sewage pumping sets, with starters, pipes, valves, &c. (G.Y. 14505.)*

Five panels of switchgear for supply to a pumping station. (A.Y. 12795.)*

WELLINGTON.—Posts and Telegraphs Department. January 23rd. Telephone equipment. (A.Y. 12776.)*

February 13th. Power relays. (A.Y. 12780.)*

February 25th. Enamelled copper wire. (A.Y. 12804.)*

Public Works Department. February 19th. 50-kV outdoor switchgear, including steelwork, for Henderson sub-station. (A.Y. 12758.)*

March 5th. Seven 8,000-kVA transformers. (A.Y. 127577.)*

Northampton.—December 17th. Town Council. Electric lighting in 1,050 houses (eleven tenders). Particulars from the borough engineer.

Northern Ireland.—ANTRIM.—December 8th. Mental Hospital Committee. Motor-generator set, &c. Particulars from F. D. Brown, 93, Ann Street, Belfast (deposit, £2).

Oxford.—December 14th. C.C. Education Committee. Rewiring and renewal of electric lighting installation and fittings at Burford Grammar school. Particulars from T. O. Willson, director of education, County Offices (deposit £1 1s.).

Reigate.—December 12th. Town Council. Electric lighting at 100 houses at Colesmead Estate, Redhill. Particulars from the borough electrical engineer.

Rowley Regis.—December 14th. Town Council. Six months' supply of various stores, including electrical requisites. Particulars from the town clerk.

Selby.—December 17th. Electric lighting at Girls' High school. Particulars from education officer, County Hall, Wakefield; tenders to Sir J. Charles McGrath, clerk of County Council, Wakefield.

Sheffield.—December 14th. Electricity Department. Steam and water piping. (November 30th.)

December 13th. Wiring and fittings at four schools. Particulars from W. G. Davies, city architect, Town Hall (deposit £2).

South Africa.—JOHANNESBURG.—January 7th. Railways and Harbours Administration. One electrically driven overhead travelling crane. (A.Y. 12760.)*

January 29th. Electricity Supply Commission. Steam-raising plant, steam turbine-driven alternators, and three feed pumps and feed heaters and surge tanks. (G.Y. 14522.)*

Swindon.—December 21st. Electricity Department. 6.6-kV, p.i., l.c. and armoured cables. (See this issue.)

Tasmania.—HOBART.—Hydro-Electric Commission. January 7th. Metering equipment. (A.Y. 12774.)*

West Riding.—December 17th. County Mental Hospitals Committee. Three-wire balancer for generating plant at Wakefield Mental Hospital. Particulars from W. E. H. Burton, architect and engineer to the Board, Mental Hospital, Wakefield.

Witney.—January 2nd. Electricity Department. 11-kV switchgear, indoor, oil-immersed, three-phase transformers, and l.p. distribution fuseboards. (November 30th.)

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* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Aberdeen.—Housing Committee. Recommended. Electric lighting work in connection with the erection of 246 houses at Froghall (£1,222).—J. B. Reid.

Birkenhead.—Electricity Committee. Accepted. Two transformers.—Metropolitan-Vickers Electrical Co., Ltd. Wiring houses under assisted scheme; L. Y. Bryan (16), Economic Electric Co. (36), Park Electric Co. (89), J. J. Peters (58).

Birmingham.—Sites and Buildings Committee. Recommended. Lighting installations at Bordesley Green Technical School (£660).—E. Cooper (Electricians), Ltd.

Glasgow.—Housing Committee. Accepted. Electrical installation at Carnwadric houses (£127).—R. J. M'Intyre.

Cleansing Committee. Accepted. Electric battery for refuse-collecting vehicle (£194).—Tudor Accumulator Co., Ltd.

Grimsby.—Electricity Committee. Recommended. L.p. cables for twelve months (£16,255).—Johnson & Phillips, Ltd.

Hull.—Telephones Committee. Recommended. Switchboards (£288).—Ericsson Telephones, Ltd.

London.—City Court of Common Council. Recommended. Electric lighting fittings for library (£665).—Higgins & Cattle, Ltd.

CAMBERWELL.—Works Committee. Recommended. Traffic signals at Peckham Road junction (£625).—Automatic Electric Co., Ltd.

Manchester.—Electricity Committee. Recommended. Sub-station switchgear (two-year contracts).—Crompton Parkinson, Ltd.; Harland Engineering Co., Ltd.; Ferguson, Pailin, Ltd. At Stuart Street station: Extensions to ash-handling plant.—International Combustion, Ltd.; removal of existing battery to new house.—Tudor Accumulator Co., Ltd. Electric goods lift at Polygon cooker shop extensions.—E. A. Foulds, Ltd. Replacement of three economisers at Barton station.—E. Green & Son, Ltd.

Northampton.—Transport Committee. Accepted. Seven electric motors (£131).—Brook Motors, Ltd.

Watch Committee. Accepted. Electrical work at Fire Station (£1,444).—Grensells (Kettering).

Oxford.—Water Committee. Accepted. Electric turbine pumping set for Headington pumping station (£325).—Mather & Platt, Ltd.

Salford.—Electricity Committee. Accepted. 500-kVA transformer (£216).—Metropolitan-Vickers Electrical Co., Ltd.

Sheffield.—Electricity Commmittee. Accepted. Six 300-kVA transformers (£828).—Electric Construction Co., Ltd. One 500,000-kVA turbo-alternator switch and remote control panels (£14,472).—A. Reyrolle & Co., Ltd. Two switch units for Blackburn Meadows station (£10,344) and two switch units for new turbo-alternator (£11,198).—General Electric Co., Ltd.

Forthcoming Events

Northampton Engineering College Past Day Students' Association.—Saturday, December 8th. Criterion Restaurant, W.1. 7.30 p.m. for 8 p.m. Annual dinner.

Institution of Electrical Engineers.—Monday, December 10th. Institution, London, 7 p.m. Informal meeting. Discussion on "Ideal Service from the Consumer's Point of View." To be opened by Mr. P. P. Wheelwright. (*East Midland Sub-Centre*).—Friday, December 7th. Victoria Hotel, Nottingham. Dinner. (*Meter and Instrument Section*).—Friday, December 7th. Institution, London. 7 p.m. "Some Suggestions towards the Improvement of Equipment and Routine Work in the Meter Departments of Supply Undertakings." Mr. J. L. Ferns. (*Tess-Side Sub-Centre*).—Friday, December 7th. Annual dance. (*London Students' Section*).—Saturday, December 8th. 10 a.m. Visit to the British Oxygen Co., Edmonton. Friday, December 14th. Institution, London. 6.30 p.m. Ordinary meeting. (*North Midland Students' Section*).—Saturday, December 8th. 2.20 p.m. Visit to the Hunslet works of J. Fowler & Co. Tuesday, December 11th. Hotel Metropole, Leeds. 7.15 p.m. Problems night. (*North-Eastern Centre*).—Monday, December 10th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "Generation, Distribution and Use of Electricity on Board Ship." Messrs. C. W. Saunders, H. W. Wilson, and R. G. Jakeman. (*Mersey and North Wales (Liverpool) Students' Section*).—Tuesday, December 11th. The University, Liverpool. 7.30 p.m. Paper by a representative from the Manchester Section. (*North-Western Students' Section*).—Tuesday, December 11th. Engineers' Club, Manchester. 7.15 p.m. "Insulation and Gas-Pressure Cables." Mr. J. H. Pirie. Thursday, December 13th. Visit to W. T. Glover & Co., Trafford Park. (*Scottish Centre*).—Tuesday, December 11th. North British Station Hotel, Edinburgh. 7 p.m. Informal meeting. "The Pit-Head Generating Station." Prof. F. G. Baily. (*South Midland Students' Section*).—Tuesday, December 11th. James Watt Memorial Institute, Birmingham. 7 p.m. "Analysis and Measurement of Noise from Machinery." Mr. C. A. Mason. Friday, December 14th. Boots' Café, Birmingham. 7.45 p.m. Annual dance. (*Hampshire Sub-Centre*).—Wednesday, December 12th. University College, Southampton. 7.30 p.m. Faraday lecture. "The Electrical Engineer and the Free Electron." Mr. C. C. Paterson. (*Irish Centre, Dublin*).—Thursday, December 13th. Physical Laboratory, Dublin. 6 p.m. Discussion on "The I.E.E. Wiring Regulations." To be opened by Mr. A. G. Bruty. (*Dundee Sub-Centre*).—Friday, December 14th. University College, Dundee. 7.30 p.m. "The Cathode-Ray Tube and its Applications." Mr. G. Parr. (*North-Eastern Students' Section*).—Friday, December 14th. Armstrong College, Newcastle-upon-Tyne. 7.15 p.m. Impromptu speech night. Saturday, December 15th. Visit to the works of Messrs. Clarke, Chapman, Gateshead-on-Tyne.

Association of Supervising Electrical Engineers.—Monday, December 10th. Royal Hotel, Bristol. 7.15 p.m. "A.C. Commutator Motors and Their Applications." Mr. R. D. Given.

Rugby Engineering Society.—Wednesday, December 12th. B.T.-H. Research Laboratory, Rugby. "Radio Interference." Mr. T. H. Kinman.

Birmingham Electric Club.—Friday, December 14th. Grand Hotel, Birmingham. 7 p.m. Annual general meeting.

Institution of Mechanical Engineers.—Friday, December 14th. Institution, London. "A General Comparison of Gas and Electricity for Heat Production." Mr. A. H. Barker.

Institution of Welding Engineers.—Friday, December 14th. James Watt Memorial Institute, Birmingham. "Electric Resistance Welding." Mr. P. Buckley.

Junior Institution of Engineers.—Friday, December 14th. Royal Society of Arts, W.C.1. 7.30 p.m. "Lighting of Streets and Roadways with Special Reference to Safety." Mr. C. C. Paterson.

Association of Mining Electrical Engineers (*South Wales Branch*).—Saturday, December 15th. Discussion of H.M. Electrical Inspectors' Report for 1933.

Notes

North Wales Engineers' Dinner

Mr. G. K. Paton (director and engineer and manager of the North Wales Power Company) presided over a gathering of nearly 150 at the fourth annual dinner of the North Wales Electrical and Communication Engineers, held at Chester on December 1st. Mr. H. Faulkner (P.O. Engineering Department), proposing "The Electricity Supply Industry," said that he looked upon the grid system as a force that united divers authorities and thus improved the prospects of the industry. Mr. J. M. Kennedy, replying, said the success of the supply industry depended upon whether they could give a supply available for the majority of the population at a price which they were able and willing to pay. The Post Office was supplying a service to practically the whole of the community at a standard rate, but in the supply industry they had over 600 undertakings each with its own systems of supply and price. Mr. W. Fennell (Mid-Cheshire Electricity Supply Co.) proposed the toast of "The Post Office Engineering Department," and Lieut.-Col. A. G. Lee (Engineer-in-Chief, G.P.O.) replied. Mr. S. E. Britton (Chester) proposed "The Electricity Undertakings of North Wales," and Mr. Arthur Hewitt (chairman, N. Wales and S. Cheshire J.E.A.) responded. The toast of "Our Guests" was proposed by Mr. G. K. Paton, and Mr. R. G. Devey responded.

I.E.E. Scottish Centre Dinner

The annual dinner of the Scottish Centre of the Institution of Electrical Engineers was held in Glasgow on November 27th and was attended by a company of 350. Prof. Francis G. Baily, chairman of the Scottish Centre, presided. Proposing the toast of "The Institution," Sir Arthur Huddleston referred to the Institution's connection with teaching and research. At the bottom of the scale, he said, was the National Certificate system, devised for evening students, to produce a uniformity of standard of examination and a record of attainment of that class of students which should enable them to produce evidence of their capacity which would be understood everywhere. In fact, it was designed to give fluidity and mobility to the junior members of the profession, and the importance of that mobility was enormous in these days when at any time the centre of gravity might be upset by the production of some new process. He paid tribute to the Joint Committee, over which Prof. G. W. Howe presided. Higher up the scale was the system under which grants were made to those reading papers and many scholarships were provided by the Institution.

Prof. W. M. Thornton, president of the Institution, replying to the toast, said each Centre had its own peculiar characteristics, and the Institution would only continue to flourish so long as its local Centres were active. He hoped that the younger men in particular would take note of anything of importance that came their way, so that they might have papers fresh from the mint of research, and not stale compilations. The toast of "The Chairman" was proposed by Mr. Norman C. Bridge.

I.E.E. South Midland Centre

The annual dinner of the Institution of Electrical Engineers, South Midland Centre, was held in Birmingham on November 30th, when the chairman, Mr. W. Burton, presided over about 320 members and guests. In proposing the toast of "The City of Birmingham," the chairman expressed the view that the area was unique with regard to the number of small industries (often one-man concerns) within it; the largest business was the electricity supply industry. The Lord Mayor (Ald. S. J. Grey), responding, stated that the undertaking, which also served a large area outside the city, now had 155,000 consumers, 80,000 of whom had been added within the last five years, during which period the consumption (excluding exports to the grid) had grown by 60 per cent. Recent reductions in tariffs had given consumers £73,000 per annum. In proposing "The Institution of Electrical Engineers," Mr. Frank Hodges (C.E.B.), emphasised that the only barriers to the applications of electricity should be those set by the human brain—not local geographical frontiers. In response Mr. R. P. Sloan (vice-president) stated that the membership of the I.E.E. had grown to 15,500 at the rate of 420 members per annum during the past ten years. He referred to E.D.A. as making the task of supply undertakings very much easier.

Mr. Alexander Ramsay, M.P. (director, Engineering and Allied Employers' National Federation) replied on behalf of "Kindred Societies and Guests," proposed by the chairman. The latter congratulated Sir Archibald Page on his appointment as chairman of the Central Electricity Board. Sir Archibald said that he regarded the friendly demonstration as indicating that they regarded the grid not as a separate entity but as the property of the industry. He believed that Sir Andrew Duncan had done more for the electrical industry in seven years than anyone else had done in twenty-one. Thanks to the chairman was proposed by Mr. J. Coxon (immediate past-chairman).

The Electrical Engineers' Ball

As already announced, the next Electrical Engineers' Ball will be held at Grosvenor House, Park Lane, W., on Friday, February 8th, 1935 (8.30 p.m. for 9.0 p.m., supper 11.30 p.m., carriages 3.0 a.m.), the day after the annual dinner of the Institution of Electrical Engineers. The Ball will be organised on the same lines as previously. As regards the accommodation, material improvements have been made which it is felt sure will add to the comfort of the guests. Tickets are now available and, as usual, are obtainable, price one guinea each, from members of the General Committee, which includes the members of the Committee of Management of the I.E.E. Benevolent Fund, under whose auspices the Ball is now being managed. The Executive Committee comprises Messrs. J. R. Cowie, W. G. Hendrey, C. W. Hill, J. W. Leach, and A. M. Sillar, Professor W. M. Thornton, and Mr. J. W. J. Townley.

Appointments Vacant

Two scientific officers for the Air Ministry Scientific Research Pool.

Consumers' engineer for Doncaster Corporation Electricity Department.

Junior charge engineer for Barrow-in-Furness Corporation Electricity Department.

Assistant master at Leyton Technical College for Essex Education Committee.

Assistant mains engineer for the Stalybridge, Hyde, Mossley & Dukinfield Tramways & Electricity Board.

Finance officer for the London & Home Counties, J.E.A.

(See our classified advertisements.)

Makers' Names Wanted

MP commutator compound.

SYRENE hair dryer.

EASY washing machine.

SAX RAY reflector with gallery.

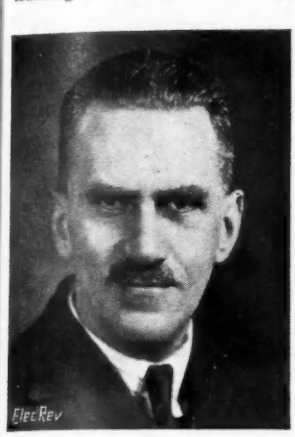
D.L.-9 low-loss dielectric insulating material.

LANBAR towel rail.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. R. Grierson, the joint author with Mr. D. Betts of the paper on the electrical warming of large buildings, which was read before the Institution of Electrical Engineers in London yesterday (Thursday), received his technical education at the University of Birmingham and his electrical training at the Mansfield Corporation electricity works. In 1907 he joined the Rochdale Corporation Electricity Department as sub-station shift engineer, and in 1910 was appointed to a similar position with Poplar Electricity Department, where he later became main station switchboard attendant. From 1910 until the outbreak of war in 1914 he was chief engineer of Provincial Cinematograph Theatres, Ltd., and its allied companies. He enlisted in the Royal Fusiliers as a private, subsequently becoming a major in the Royal Engineers. On demobilisation in 1919 he resumed his appointment with Provincial Cinematograph Theatres, Ltd., and its allied companies, for whom he toured America and Canada. He became technical director of Messrs. Grierson, Ltd., in 1922, a position which he still holds. He was elected an associate member of the I.E.E. in 1912, and became a full member in 1932. He has served on the Council of the Institution, and on a number of Committees. He is a member of the council of the Institution of Heating and Ventilating Engineers, has served on the E.D.A. Council, and from 1927-33 was a member of the Council of the E.C.A.



Mr. R. Grierson [*Lafayette.*

Mr. J. Wardle is retiring from his association with the London Passenger Transport Board at the end of the year, after forty-three years of varied transport experience. He was for twenty years commercial manager of the Metropolitan Railway Co. until its recent inclusion in the amalgamation controlled by the Board.

Mr. E. R. Briggs, M.Inst.C.E., M.I.Mech.E., has severed his connection with the English Electric Co., Ltd. He has been actively engaged for many years in the design of power stations and in the development and manufacture of steam engines and turbines, oil engines and water turbines at the Rugby works (formerly Willans & Robinson, Ltd.) of the company.

The Marchese Marconi, acting on medical advice, has decided to take a complete rest from work and has entered a London nursing home, where he will stay for a few weeks.

Mr. T. A. Nunwick, the Lancashire representative of the Midland Electric Manufacturing Co., Ltd., is retiring from active work on the road at the end of the present year, although he will not be entirely severing his connection with the company. He commenced his career in the electrical industry in 1887 with the late Wilson Hartnell, of Leeds, and in 1889 he joined the firm of Poole & White, Ltd., as representative. Afterwards he represented Dorman & Smith, of Salford, for sixteen years, and subsequently joined the M.E.M. Co., from which he is now retiring after eighteen years' service. His address is 29, Delamere Road, Ainsdale, Southport. **Mr. J. W. Waterhouse,** who has been Yorkshire representative of the company for the past twelve years, is to succeed Mr. Nunwick in looking after its interests in the Lancashire territory.

Mr. T. A. Nunwick

Mr. J. E. Taggart has been appointed by the Government of the Punjab as executive engineer in the Electricity Branch of the Punjab Public Works Department.

Sir Archibald Page, M.Inst.C.E., past-president of the Institution of Electrical Engineers, has been appointed chairman of the Central Electricity Board as from January 1st next. **Sir Andrew Duncan,** who retires from the chairmanship after nearly eight years to join the British Iron and Steel Federation, as already announced, has been appointed an ordinary member

[*Elliott & Fry.*

Sir Archibald Page and Lord Barnby

of the Board in place of **Lord Barnby,** who is retiring. These appointments were announced in the House of Commons on November 29th. As our readers are already aware, Sir Archibald Page became general manager and chief engineer to the Board in the year 1927. Reference to his work is made in our "Leader" section. Thirty years ago he was deputy city electrical engineer at Glasgow, and after that he spent several years as general manager of the Clyde Valley Electric Power Co. He became an Electricity Commissioner in 1920, continuing until 1925, when he went for two years to the County of London Electric Supply Co., joining the Central Board in 1927, as stated above. Sir Archibald is fifty-nine years of age.

Mr. J. H. Greenwood, A.M.I.E.E., of the Stalybridge, Hyde, Moseley and Dukinfield Tramways and Electricity Board, has been appointed mains engineer with the Willesden Corporation Electricity Department.

Mr. A. Storry, senior electrical assistant with Messrs. G. N. Haden & Sons, has been appointed by the Ipswich Corporation Electricity Committee as technical assistant in the Consumers' and Installation Department of the electricity undertaking.

Mr. Bernard Price, O.B.E., general manager and chief engineer of the Victoria Falls & Transvaal Power Co., Ltd., has left for South Africa after a six-months' visit to this country.

Mr. C. Mancha Bennett, the author of the article entitled "Whither Service?" which appears on page 795, served a pupilage at the Thames Iron Works & Shipbuilding Co., Ltd., Blackwall, under Mr. Arnold F. Hills. After spending many years there, working through the various shops and on outside contracts, he was for two years in experimental and research work, later becoming an assistant engineer to the Kensington & Knightsbridge Electric Lighting Co., Ltd. When this company combined with the Notting Hill Electric Lighting Co., Ltd., in erecting a joint power house at Wood Lane, Mr. Bennett was appointed engineer on site, and had complete charge of the civil, mechanical and electrical equipment of the station, with the design of which he had a good deal to do, and on its completion was appointed resident engineer, eventually becoming chief engineer to the joint companies, in which capacity he designed and constructed, with the companies' own staff of workmen, the second power house on the same site. When the Wood Lane works was taken over and closed down by the London Power Co. he was appointed chief control engineer to the London Power Co., a position which he still holds.

Mr. C. Mancha Bennett

He became an associate of the Institution of Electrical Engineers in 1899, and a full member in 1920.

Major F. Collins, controller of the telegraph and telephone branch of the South African Posts and Telegraphs Department at the Pretoria headquarters, has arrived in England.

Mr. H. Manley Roberts, M.I.E.E., electrical engineer to the Ebbw Vale Steel, Iron & Coal Co., Ltd., has been elected to the vice-chairmanship of the Western Centre of the Institution of Electrical Engineers owing to the withdrawal of **Mr. J. W. Bowman,** M.I.E.E., of the Rhondda Tramways Co., Ltd.

Mr. T. N. Riley, D.S.C., M.Sc., M.I.E.E., formerly assistant director of the research laboratories of the International Telephone & Telegraph Corporation, has joined the board of G.V.D. Illuminators, Ltd. In the "New Companies Registered" section of our last issue this company was incorrectly referred to as G.V.D. Illuminations, Ltd.

Mr. J. T. H. Legge has resigned from the position of managing director of Edmundson's Electricity Corporation, Ltd., and his directorships of the associated companies.

Mr. W. A. Royle, electrical engineer to the Blackburn Corporation, who is leaving to take up a similar position at Sunderland, has been presented with a cabinet of cutlery from the staff and employés of the electricity undertaking, in co-operation with the Sports and Social Club. The Mayor (Ald. C. A. Critchley), chairman of the Electricity Committee, made the presentation. Mr. R. H. Harral, who is succeeding Mr. Royle, spoke of the great progress the undertaking had made under Mr. Royle's direction. Mr. Royle declared that he only took credit for having been leader of a good team.

Lt.-Col. T. W. Foinette, president of the Midland branch of the Association of Mining Electrical Engineers, has relinquished his appointment of Deputy Assistant Director of Ordnance Services on the staff of the G.O.C. 46th (North Midland) Division (Derby) and the command of the 46th (North Midland) Divisional Royal Army Ordnance Corps (T.A.). He has held these appointments for the past eight years. Col. Foinette, who is with the Nottingham Corporation Electricity Department, retains his rank on retirement.

Mr. E. Ross, who for nine years has been in the Sales Department of the Doncaster Corporation electricity undertaking, has been presented by his colleagues with a gold wristlet watch on leaving to take up a similar appointment in the South of England.

Colonel S. E. Monkhouse, of the North-Eastern Electric Supply Co., Ltd., has resigned from the chairmanship of the North-East Development Board for business reasons. This Board was formed to encourage the setting up of new industries in the area. **Lord Ridley** succeeds him as chairman.

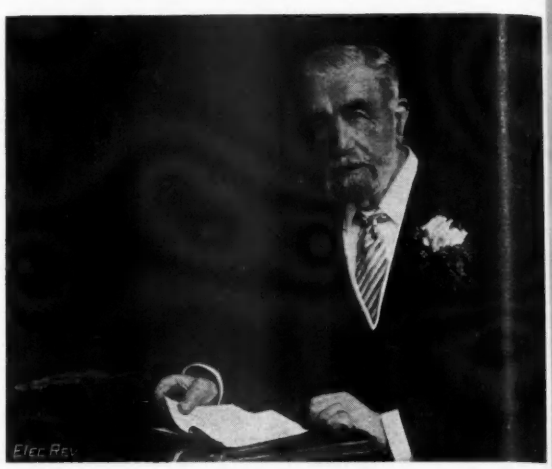
Mr. L. Young has been appointed provincial sales manager to British Electric Domestic Appliances, Ltd.

Dr. T. E. Allibone

Dr. T. E. Allibone, of the Research Department at the Metropolitan-Vickers Electrical Co.'s works at Trafford Park, has received the Röntgen Award, which is given by the Council of the British Institute of Radiology, for his contributions on continuously evacuated X-Ray tubes and rectifiers. The papers on which the award was based described tubes and generators for deep therapy applications. Several continuously evacuated X-Ray tubes and high-voltage d.c. generators have been installed in hospitals in this country by the Metropolitan-Vickers Electrical Co., Ltd., the development of these tubes being carried out in their laboratories at Trafford Park. Dr. Allibone, one of whose papers contains a description of his early work carried out in the Cavendish Laboratory, was largely concerned with this development.

Obituary

Mr. J. B. Braithwaite.—Mr. Joseph Bevan Braithwaite, who died last week at his holiday home, Burnham-on-Sea, at the age of seventy-nine years, was one of the most interesting financial personalities in the City of London for several reasons, but here we are called upon to pay special tribute to his optimism concerning electricity supply between forty and forty-five years ago. Those of our readers who can recall the days of the flotation of the City of London Electric Lighting Company and the County of London Company, and the early affairs of the Brush Electrical Engineering Co., Ltd., will remember the conspicuous part that he played in connection with these concerns. As chairman of these and other companies, it was always revealed at shareholders' meetings what a complete master he was of the financial and general details of each. He became a partner in his uncle's firm—Foster & Braithwaite, stock and share brokers—in 1880 (retiring in 1922). He was instrumental in finding the capital with which



[*Lafayette.*

The late Mr. J. B. Braithwaite

the City and County Companies were formed at a time when electric lighting seemed to have a very remote chance of succeeding against gas. In this matter it is said that he was associated with the late Lord Rothschild. He retained his belief in the great prospects before the electrical industry throughout, and was still chairman of the City Company at the date of his decease. The Melbourne and Adelaide companies also are numbered among the electricity concerns in which he was actively interested. His connection with the Brush Electrical Engineering Co. began in about 1893, when he followed the late Duke of Marlborough in the chairmanship just after the company had removed its manufacturing operations from London to Loughborough. It is curious, in looking back now at the ELECTRICAL REVIEW's record of his speech to Brush shareholders, exactly forty years ago, to find that on that occasion he referred to the "prevalent industrial depression" and to the difficulties of the Australian branch through the financial crisis in the Colonies. Much else might be said regarding the life of a man who worked so confidently and so soundly for the development of pioneering electrical companies, whose rewards were later to be begrudged them by critics who never knew the crises and difficulties which they had had to face. His other great interest in life beside finance was a simple but consistent attachment for and strong support throughout of the Society of Friends, reminding electrical men at once of the great similar interest which was also conspicuous of the private life of the late Dr. Silvanus P. Thompson.

Sir R. W. Perks.—The death of Sir Robert William Perks, Bt., occurred on November 30th, at the age of eighty-five years, at his home in Kensington Palace Gardens, W. Sir Robert, as a lawyer, had many interests in connection with railway and other engineering matters, but those who remember the change that took place on the Metropolitan District Railway when it was electrified at the beginning of the present century will place that conversion prominently among the improvements for which credit is largely due to him. The old "District" tunnels were constructed for steam locomotion, but without sufficient outlets for the escape of smoke, and the discomfort to passengers from smoke and steam would be a nightmare to-day. Things were so bad that Board of Trade inquiries were held and Blue Books were issued regarding it, and the Board of Trade made a threat to close it down if it was not electrified. Sir Robert followed Mr. J. Staats Forbes as chairman of the company in 1901, and held that office during the period of electrification. He became deputy chairman when Mr. C. T. Yerkes came over from the States, and took the chair in 1905. Sir Robert resigned in 1907. He was made a baronet in 1908.

Sir Horace Lamb.—The death occurred at Cambridge, on December 4th, at the age of eighty-five, of Sir Horace Lamb, the eminent mathematical physicist, and a past-president of the British Association.

Mr. F. W. G. Towers.—The death occurred on November 29th of Mr. F. W. G. Towers, for many years representative of the Benjamin Electric, Ltd., in North-East England.

Will.—Prof. W. C. Clinton, holder of the Pender Chair of Electrical Engineering at University College, London, left £16,493, with net personalty £15,859. He gave all his property to his sister, Mary Clinton, and expressed the wish that at her death she should leave everything to University College.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Architectural Lighting, Ltd.—Private company. Registered November 30th. Capital, £5,750 in 5,000 6 per cent. redeemable preference shares of £1 each and 15,000 ordinary shares of 1s. each. Objects: To carry on the business of electricians, mechanical engineers and manufacturers and workers of and dealers in electricity, motive power and light, &c. The first directors are Clifford H. Longden-Griffiths, John F. Caie, and Major Stuart L. McWatt. Registered office: 19a, Coleman Street, E.C.

Universal Electrical Laboratories, Ltd.—Private company. Registered November 26th. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in all machinery and plant relating to electrical and radio appliances, &c. The first directors are: G. Rose, address not stated, and three others. Registered office: 91, Union Road, Cricklewood, N.W.2.

Joubert & Wright, Ltd.—Private company. Registered December 1st. Capital, £2,000 in £1 shares (875 7 per cent. cumulative preference and 1,125 ordinary). Objects: To acquire the benefit of an agreement, dated November 23rd, 1934, whereby Charles M. Wright was appointed sole distributor for the sale of the electric lamps of the Aldwych Lamp Co., Ltd., for the territory therein defined, and to carry on the business of electricians, mechanical engineers, &c. The permanent directors are: M. Joubert (chairman), 2c, Kempshott Road, Streatham, S.W.16; and C. M. Wright, 5, Alverstone Road, New Malden, Surrey. Registered office: 6, Weston Park, Kingston-on-Thames.

Carlingford Electricity Co., Ltd.—Private company. Registered in Dublin November 23rd. Capital, £1,200 in £1 shares. Objects: To produce and generate, and distribute, utilise and sell electricity generated by the company. The subscribers are: J. Banks, 9, Clare Street, Dublin, and Mrs. Annie J. Hughes, Newry Street, Carlingford, Co. Louth.

F. Gaskell, Ltd.—Private company. Registered November 27th. Capital, £500 in £1 shares. Objects: To carry on the business of electrical, wireless, mechanical and general engineers, contractors, dealers in electrical, wireless and television apparatus, &c. The first directors are: F. Gaskell, electrical engineer and contractor, and Mrs. Mary V. Gaskell, both of 51, Hatchford Road, Olton, Birmingham. Secretary: John H. Hudson. Registered office: 93, Stoney Lane, Sparkbrook, Birmingham.

Mica Elements, Ltd.—Private company. Registered November 28th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in mica elements, electrical and wireless apparatus, &c. The permanent directors are: T. Riley, The Gables, 55a, Radcliffe Road, West Bridgford, Notts; S. Bell-Brown, Manor Lane, Mansfield, Notts; A. J. Holmes, 119, Hawton Crescent, Wollaton Park, Nottingham. Secretary: T. Riley.

Lighting, Heating & Traction Supplies Co., Ltd.—Private company. Registered November 29th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, mechanical engineers, &c. The first directors are: E. N. Bacon, 56, West Heath Drive, Golders Green, N.W.11, and R. H. Markes, 60, Pinner Park Avenue, Headstone Lane, Harrow. Registered office: 51, Doughty Street, W.C.1.

Returns of Electrical Companies

Burnham and District Electric Supply Co., Ltd.—Satisfaction to the extent of £3,000 and £1,000 on August 24th, 1934, of debentures dated March 12th, 1914, and March 2nd, 1920, and registered March 14th, 1914, and March 10th, 1920, respectively.

Bourton-on-the-Water Electric Light and Power Co., Ltd.—Satisfaction to the extent of £300 on October 29th, 1934, of mortgage dated February 12th, 1931, and registered February 20th, 1931.

Rural Electricity Supply Co., Ltd.—Capital, £10,000 in 9,500 preference shares of £1 and 10,000 deferred shares of 1s. each. Return dated August 17th, 1934. 5,512 preferred and 5,713 deferred shares taken up. £3,156 13s. paid on 2,871 preferred and 5,713 deferred shares. £2,641 considered as paid on 2,641 preferred shares. Mortgages and charges nil.

General Cable Manufacturing Co., Ltd. (old company).—Satisfaction to the extent of £35,325 on November 15th, 1934, of debentures authorised April 12th, 1933, and registered April 26th, 1933.

United Ebonite Manufacturers, Ltd. (in liquidation).—Satisfaction in full on August 16th, 1934, of debenture dated May 16th, 1929, and registered May 22nd, 1929. (According to the register of mortgages, the debenture registered May 22nd, 1929, originally secured all moneys due to bank.)

Lancashire Wire Co., Ltd.—First debenture, dated November 19th, 1934, to secure £20,000, charged on the company's undertaking and property, present and future, including uncalled and unpaid capital. Holders: Westminster Bank, Ltd.

Peerless Electrical Manufacturing Co., Ltd.—Capital, £50,000 in 46,500 shares of £1 and 70,000 shares of 1s. Return dated October 15th, 1934. 37,500 £1 shares and 48,368 1s. shares taken up. £37,896 10s. paid. £371 18s. calls unpaid. £1,650 considered as paid. Mortgages and charges £14,500.

Southern Electric Free Wiring Co., Ltd.—Capital, £5,000 in £1 shares. Return dated October 10th, 1934. 1,510 shares taken up. £1,510 paid. Mortgages and charges nil.

Insulators, Ltd.—Issue on November 1st, 1934, of £2,000 debentures, part of a series already registered.

City Notes

The Melbourne Electric Supply Co., Ltd., proposed to capitalise £400,300 of its undivided profits and to distribute a capital bonus equal to 50 per cent. to holders of consolidated ordinary stock. Stockholders will receive one new £1 ordinary share for every £2 of consolidated ordinary stock held. The issue will be made out of the shares at present unissued and no increase of the nominal capital will be necessary, but as some of the unissued shares were created as preference shares, it will be necessary first to convert such unissued preference shares into ordinary shares. An extraordinary meeting will be held at Melbourne on December 28th to pass the necessary resolutions.

Veritys, Ltd., have issued a formal notice to the holders of their 6 per cent. mortgage debenture stock, to comply with the trust deed, relating to deferred drawing of stock; the majority of the holders have already agreed. The step is really for the purpose of providing the means to cope with considerably increased business which calls for plant extensions. For some time past the directors have had under consideration a scheme for the reconstruction of the company, and it is hoped that before the end of the year a meeting of debenture-stockholders will be called to obtain their consent to a scheme.

The British Electric Traction Co.—It is announced in the daily Press that the electricity supply undertakings under the control of the British Electric Traction Co. are to be separated from the main part of the business. It is considered probable that a new company, to be called the B.E.T. Electricity Supply Co., will be formed which would have a capital of £750,000. In addition, there would be £350,000 of 4 per cent. debenture stock. The B.E.T. Co. controls the electricity supply companies in Antrim, Birkdale, Lewes, Merthyr, Penarth, Sheerness, and Weston-super-Mare.

Crompton Parkinson, Ltd.—At the annual meeting which is being held to-day (Friday) a resolution will be submitted providing for the capitalisation of £15,234 of the reserve fund and for its distribution by way of bonus to the ordinary and "A" ordinary shareholders in the form of 60,937 "A" ordinary shares of 5s. each fully paid in the proportion of seven "A" ordinary shares for every 100 ordinary and/or "A" ordinary shares held. The new shares will rank for dividend as from October 1st last, and in other respects, *pari passu*, with the existing "A" ordinary shares.

The Shropshire, Worcestershire and Staffordshire Electric Power Co. has decided to issue forthwith 500,000 £1 "B" ordinary shares, the creation of which was sanctioned at an extraordinary meeting held on November 27th. The new shares are offered to the "A" and "B" ordinary shareholders *pro rata* to their present holdings. The price of issue of the new shares is 22s. 6d. per share, and they will rank, *pari passu*, with the existing "B" ordinary shares as and from January 1st next. Applications will be received up to December 31st. This offer will bring the issued capital up to £5,000,000.

The Cie. Parisienne de Distribution d'Electricité is increasing its capital from 200 to 300 million francs. The new capital is to be offered to the holders of the company's "A" shares. At the recent annual meeting the president of the company said that they were in a very favourable position and he claimed that the company's charges for electricity were the lowest in Europe.

Turner & Newall, Ltd., report a net profit for the year ended September 30th last of £714,228, as compared with £307,572 in the preceding year, to which is added £106,126 brought in, making £820,354. The ordinary dividend for the year is 10 per cent. (against 5 per cent. in 1932-33) and £130,513 is carried forward.

Edmundson's Electricity Corporation, Ltd., has declared an interim dividend of 3½ per cent., less tax, on the ordinary shares, for the year ending March 31st, 1935. This compares with an interim dividend of 3 per cent., less tax, declared last year.

The British Power & Light Corporation (1929), Ltd.—At an extraordinary meeting held on November 30th a resolution was passed authorising the issue of 200,000 of the unissued £1 ordinary shares as preference shares.

The British Columbia Power Corporation has announced a quarterly dividend of 37 cents per share on the class "A" shares (same).

The Globe Telegraph & Trust is paying a quarterly dividend of 1s. net per £10 ordinary share (unchanged).

W. & T. Avery, Ltd., have declared an interim ordinary dividend of 5 per cent., less tax (same).

The Canadian General Electric Co. is paying the usual quarterly dividend of 75 cents on the common shares.

Stocks and Shares

TUESDAY EVENING.

LITTLE indication is yet apparent of any diminution in the public appetite for investment stocks and shares. It is true that part of last month's substantial rise in the ordinary shares of the electricity supply companies has been lost, but the reactions are small as compared with the advances which took place upon publication of the news respecting the Central London Electricity Distribution Committee, 1934, Ltd. In the group of gilt-edged stocks as distinct from shares, the demand on the part of the public is insatiable for anything that pays from 3 to 3½ per cent. on the money. The City and County of York achieved something like a record a few days

ago in the receiving of applications amounting to 22 million pounds stock for the modest half-million that the borrowers required.

After many weeks of expectancy the award has been published in the matter of the London Passenger Transport Board and Thomas Tilling. Expectations differed widely. Some people thought that Tillings would receive a million pounds; others said that nothing short of three million pounds would be a fair award. The directors had claimed £3,162,000 in Transport stocks. The actual figures came out at £1,750,000, the bulk of this being payable in the "C" stock of the London Passenger Transport Board. The total amount, 1¾ million pounds, was taken at par, but on the middle market prices of the date of the award, the total capital value worked out to £1,618,397. As this item appeared in the Tilling accounts last September at £225,330, there remained a surplus of nearly £1,400,000, which Tillings propose to carry to their general reserve fund. Upon publication of the award Transport "C" hardened to 92. The stock is in receipt, at the present time, of a 3 per cent. dividend, which yields, as our tables show, 3¼ per cent. on the money. The stock is entitled, however, to a dividend up to 5¼ per cent. if earnings allow. With this prospect in view, holders of and believers in the stock calculate that 100 is not an extravagant value to put upon the security. It may be remembered that earlier in the present year the price has been down as low as 73. At the other end of the scale it touched 95 a few months ago.

The Underground Electric Railways liquidator announces a cash distribution to the shareholders of 2d. per share, and estimates that there may be another 1d. per share to come. Cheques in respect of this payment will be distributed at the end of the month. Associated Equipment shares are quoted at 35s.

Electricity Supply Shares

Central Board stocks are steady at their previous prices. The reaction in prices of the ordinary shares of the Home electricity supply companies, to which reference has been made above, has lowered County of London shares 1s. 6d., and North Metropolitan ordinary the same amount, to 57s. 6d. and 64s. 6d. respectively. Midland Electric Power shares are ⅛ down at 47s. 6d. The other falls range from 6d. to 1s. It is said in the market that the abrupt rise in prices a fortnight ago tempted a few shares to market upon consideration of the slender yield which is now available at the standard rate of dividend, 7 per cent., paid by most of the London companies for 1933. There is a general impression, however, that this rate will be increased to 7½ per cent. for 1934, and that the February dividends will fulfil this hope. A number of the companies have recently announced reductions in their charges for electricity, and this is regarded as being in itself significant in its relation to dividend distributions.

British Light & Power shares firmed up to 22s. 6d. The new issue of 6 per cent. preference shares are to be offered at 28s. 9d. The yield at this price will be 4¼ per cent. on the money.

Cables and Wireless

The market in Cables and Wireless stocks after being dull suddenly developed strength. The 5½ per cent. preference shot up 3 points, to 83, and the A ordinary put on 15s. with an advance to 18. Globe Telegraph and Trust preference continue their rise, the price being now up to 13½ ex dividend. Quarterly interim dividends of 3s. on the preference, and 1s. net on the ordinary have been declared by the company. Anglo-American Telegraph preference at 121 is a point to the good, and the deferred stock retains its jump to 30½. There has been less animation in American Telephone and Telegraph shares, the price remaining at 110¼. International Telephone and Telegraphs are back to 9⅜. Marconi Marines at 33s. 9d. show ⅛ rise.

Miscellaneous Matters

Crompton Parkinson shares have improved to 34s. ex dividend upon the issue of the full accounts of the company to September last. These showed that the trading profit had gone up by £30,300. The other figures are highly satisfactory, and the meeting on Friday in this week is likely to prove a pleasant function. Edmundson's Electricity ordinary at 42s. 3d. are ex the dividend which is to be paid on Wednesday next week of 3¼ per cent., which goes against 3 per cent. a year ago. Edmundson's is controlled, of course, by the Greater London and Counties Trust, which itself is a subsidiary of Utilities Power and Light Corporation of the U.S.A. Aron Electricity ordinary have slipped back to 70s. Ferranti preference are a feature of strength at 30s. 9d., which is 1s. 9d. higher on the week. Inquiry for English Electric preference raised the price to 10s. 9d. Lissen 8 per cent. preference have come down from a recent 25s. to the somewhat nominal price of 17s. 6d. No special reason has been given to account for the fall and explanation is awaited with interest. Telephone Rentals are better at 9s. 4½d. British Electric Traction deferred stock at 925 has recovered 25 points upon announcement by the company that it intends to segregate the electricity Supply companies from the main part of the business. The present price of the stock, 925, is exactly double that at which it stood earlier in the year. Fuller details will be found elsewhere of the manner in which the segregation of assets is, according to present proposals, to be made. The announcement came as something of a surprise.

Share List of Electrical Companies

	Nom.	Dividend. 1932.	Dividend. 1933.	Price. Dec. 4.	Rise or Fall.	Yield p.c. £ s. d.
Home Electricity Companies.						
Bournemouth and Poole	1	15	15	78/9	—	3 16 1
Brompton Ordinary	1	7	7	36/–	—	3 17 1
Charing Cross Ordinary	1	7	7	36/–	—	3 17 1
Chelsea	1	7	7	36/–	—	3 17 1
City of London	1	7½	7½	38/6	—	3 18 1
Clyde Valley	1	7	7	42/–	–6d.	3 6 11
County of London	1	10½	10½	57/6	–1/6	3 13 1
Edmundson's 7% Pref.	1	7	7	37/6	—	3 14 1
Elec. Dis. Yorkshire	1	9	9	50/6	—	3 11 1
Elec. Supply Corporation	1	11	11	3	—	3 13 1
Kensington Ordinary	1	7	7	36/–	—	3 17 1
Lancs Light and Power	1	7	7½	38/6	–6d.	3 18 1
London Electric	1	7	7	37/–	–6d.	3 15 1
Metropolitan	1	10	10	54/–	–1/–	3 14 1
Midland Counties	1	7	7	39/–	–1/–	3 11 10
Mid. Elec. Power	1	8	8	47/6	–⅛	3 7 7
North Eastern Electric Ordinary	1	6	6	35/–	—	3 8 7
Do. 7% Pref.	1	7	7	35/–	—	4 0 0
Northampton	1	10	10	56/3	–9d.	3 11 1
Notting Hill 6% Pref.	10	6	6	14½	—	4 4 4
North Met. Elec. Ordinary	1	10	10	64/6	–1/6	3 2 0
Do. do. 6% Pref.	1	6	6	32/6	—	3 13 10
St. James' and Pall Mall	1	7	7½	38/6	—	3 18 0
Scottish Power	1	8	8	42/6	–6d.	3 15 5
South London	1	7	7	36/–	—	3 17 0
Westminster Ordinary	1	7	7	36/6	—	3 16 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	21/6	—	6 19 6
Yorkshire Elec.	1	8	8	48/–	–6d.	3 6 8
Public Boards.						
Central Electricity, 1950–70	Stock	5	5	116	—	4 6 0
Do. 1955–75	„	5	5	118	—	4 4 0
Do. 1951–73	„	4½	4½	110xd	—	4 1 10
Do. 1963–93	„	—	3½	102	—	3 8 6
London & Home Counties, 1955–75	„	4½	4½	112	—	4 0 4
London Passenger Transport, A	„	—	4½	123½xd	—	3 13 0
Do. do. B	„	—	5	127½xd	—	3 18 5
Do. do. C	„	—	3	92	+1	3 5 3
West Midlands Joint Elec. 1948–68	„	—	5	118	—	4 4 0
Telegraph and Telephone.						
American Tel. & Tel.	$100	9	9	110½	—	8 2 10
Anglo-Am. Tel. Pref.	Stock	6	6	121	+1	4 19 2
Do. Def.	„	1½	1½	30½	—	4 18 4
Cables & Wireless 5½% Pref.	„	2¾	2¾	83	+3	3 6 3
Do. A. 7½% Ord.	„	Nil	Nil	18	+¾	—
Do. B. Ord.	„	Nil	Nil	7	—	—
Globe Tel. and T. Ord.	10	Nil	2½	10½xd	+1/–	2 8 7
Do. do. Pref.	10	6	6	13½xd	+¾	4 9 0
Great Northern Tel.	10	20	20	38	—	5 5 3
Marconi-Marine	1	10	7½	33/9	+⅛	4 9 0
Oriental Telephone Ord.	1	12	12	3¾	—	*3 13 10
Home and Foreign Trams, Etc.						
Anglo-Arg. Trams First Pref.	5	Nil	Nil	1/6	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	„	5	5	925	+25	—
Do. do. Pref. Ord.	„	8	8	167½	—	4 15 7
Brazil Traction	100	—	—	10¾	—	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	107	+1	4 13 6
Mexico Trams, 5% Bonds	—	5	5	19½	–2	—
Mexican Light Common	100	Nil	Nil	3½	+1	—
Do. 7% Pref.	100	7	7	4½	—	—
Do. 1st Bonds	—	5	5	45	+5	—
Victoria Falls Ord.	1	15	20	6⅛	+⅛	2 19 2
Yorkshire (West Riding)	1	2½	5	25/6	—	3 18 5
Manufacturing Companies.						
Aron Electricity Ord.	1	10	10	70/–	–½	2 17 2
Assoc. Elec. Ord.	1	4	3	24/6	—	2 9 0
Do. Prf.	1	8	8	33/9	—	4 14 10
Babcock & Wilcox	1	9	6	45/9	–9d.	2 12 6
British Aluminium Ord.	1	5	5	29/6	—	3 7 9
British Insulated Ord.	1	15	15	77/6	—	3 17 6
Brush Ord.	Stock	Nil	Nil	37½	—	—
Callender's	1	15	15	3⅞	—	4 9 0
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord.	5/–	22½	12½	34/–xd	+1/–	1 16 10
Do. 8% Pref.	1	8	8	35/–xd	+⅛	4 11 5
Edison-Swan 1st Pref.	1	7½	7½	23/9	—	6 6 4
Electric Construction	1	Nil	Nil	17/6	—	—
Enfield Cable Ord.	1	25	20	4½	—	4 2 0
English Electric	1	Nil	Nil	6/3	—	—
Do. do. Pref.	1	Nil	Nil	10/9	+9d.	—
Ever Ready	5/–	35	35	27/3	—	6 8 5
Ferranti Pref.	1	7	7	30/9	+1/9	4 11 7
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	8	8	49/6	—	3 4 6
Henley's	1	30	30	6⅝	—	4 8 0
Do. 4½% Pref.	5	4½	4½	5⅛	—	3 18 3
India-Rubber Preferred	1	—	—	1	—	—
Johnson & Phillips	1	5	5	30/–	—	3 6 8
Siemens Ord.	1	6½	4	1	—	4 0 0
Telegraph Construction	£1	Nil	Nil	1¼	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged and all subsequent proceedings will be taken.

1932

10025. "Means for use in recording sound and other vibrations." H. W. Aldrich and W. Gannon. May 8th, 1933. (419204.)

1933

3571. "Photo-electric apparatus." A. S. Fitzgerald. February 4th, 1932. (419307.)

5886. "Electric clocks." Ferranti, Ltd., and W. Holmes. February 27th, 1933. (Cognate application 6457/34.) (419059.)

6278. "Apparatus for medical treatment with electrical oscillations of very high frequency." Siemens & Halske Akt.-Ges. March 30th, 1932. (419136.)

6300. "Wireless receiving systems." C. A. S. Jensen. March 1st, 1932. (419137.)

6797. "Tap-changing apparatus for electric transformers." General Electric Co., Ltd., W. Wilson, and J. W. Gibson. March 6th, 1933. (419283.)

6866. "Inductance coils and the like for use in radio-frequency current circuits." Electric & Musical Industries, Ltd., and A. D. Blumlein. March 7th, 1933. (419284.)

9981. "Jacketed steel electrodes for electric arc welding." Naamlooze Vennootschap Machinerieen - en Apparaten Fabrieken. August 9th, 1932. (419285.)

10420. "Electric accumulator plates." J. Lucas, Ltd., and J. Merrick. April 7th, 1933. (419142.)

10845. "Electrical apparatus for compensating for an earth-fault current." International General Electric Co., Inc. April 12th, 1932. (419360.)

12636. "Transformers, choking-coils and the like." W. H. Wilson. May 1st, 1933. (419289.)

12650. "Polarised electric relays." Siemens and General Electric Railway Signal Co., Ltd., and J. S. Cook. May 1st, 1933. (419290.)

12770. "Means for regulating electric power transmission systems." International General Electric Co., Inc. May 2nd, 1932. (419146.)

12796. "Electrical heat-radiating panels." E. M. Young and Unity Heating Co., Ltd. May 2nd, 1933. (419147.)

12951. "Methods for purifying electric insulating liquids." Minister of Communications of the Imperial Japanese Government. May 25th, 1932. (419292.)

13233. "Electric switches specially applicable to switches for combined fuse and switch-boxes for lighting circuits." V. Hope. May 6th, 1933. (419300.)

13248. "Kerr and like cells and methods of manufacturing the same." Marconi's Wireless Telegraph Co., Ltd., and E. G. Herriott. May 6th, 1933. (419072.)

13249. "Thermionic amplifiers." Marconi's Wireless Telegraph Co., Ltd., and V. O. Stokes. May 6th, 1933. (419073.)

13456. "Illuminating means for the indicators of finger-operated change-speed gear levers." G. H. Patterson. May 9th, 1933. (419305.)

13382. "Cathode-ray tubes." Marconi's Wireless Telegraph Co., Ltd., and W. E. Bentham. May 12th, 1933. (419379.)

14771. "Synchronising arrangements for sectionalised bus-bar systems." M. W. Adamson and Associated Electrical Industries, Ltd. May 22nd, 1933. (419224.)

14910. "Moving and flashing advertising signs." J. F. Morriss. May 23rd, 1933. (419313.)

16668. "Electric torches." Ever-Ready Co. (Great Britain), Ltd., and M. Van Kiningsveld. June 10th, 1933. (419386.)

16796. "Electrical terminal connection." C. St. Noble. June 12th, 1933. (419227.)

17347. "Electric circuit controlling devices of the thermal type." J. G. Smithson & Co., Ltd., and J. G. Smithson. June 17th, 1933. (419390.)

18051. "Thermionic cathodes." M-O Valve Co., Ltd., C. J. Smithells and L. R. G. Treloar. June 24th, 1933. (419096.)

19015. "Electrodeposition of metals." A. I. Wynne-Williams. July 4th, 1933. (Cognate application 26773/33.) (419391.)

19213. "Apparatus for testing telephones." E. J. Barnes, R. E. Swift, O. W. Gill and J. Wood. July 6th, 1933. (419392.)

20677. "Plug-in electric switches." J. Hampton. July 22nd, 1933. (419321.)

20791. "Electrical timing apparatus." G. D. Flanagan. July 24th, 1933. (Convention date not granted.) (419103.)

21144. "Cycle and like electric lamps." E. R. Nier, E. E. Nier, E. Nier and J. M. Ehmer (trading as Nier and Ehmer). August 27th, 1932. (419105.)

21902. "Electric plug-and-socket connectors." J. B. Tucker. August 4th, 1933. (419231.)

22717. "High-frequency electric conductors and radio aerials." Telefunken Ges. für Drahtlose Telegraphie. August 12th, 1932. (419396.)

23187. "Method of and apparatus for detecting faults in rods or the like of magnetic material." A. M. Armour and Associated Electrical Industries, Ltd. August 19th, 1933. (419110.)

23473. "Electric measuring instruments." British Thomson-Houston Co., Ltd. August 23rd, 1932. (419397.)

24142. "Construction of light-sensitive cells." H. Fitzherbert and H. G. Hughes. August 31st, 1933. (419233.)

24955. "Systems for the communication of control or signal influences, more particularly for centralised traffic-controlling installations for railways." General Railway Signal Co. October 28th, 1932. (419399.)

25215. "Electric radiation or grill hoods." Porzellanfabrik P. Rosenthal and Co. Akt.-Ges. September 15th, 1932. (419160.)

26182. "Key-operated electric tumbler switches." A. P. Lundberg & Sons, Ltd., and G. Pegg. September 22nd, 1933. (419114.)

26351. "Clock-operated electric alarms." A. H. Shiers. September 25th, 1933. (419400.)

26615. "Systems for the communication of control and/or signal influences, more particularly for centralised traffic controlling installations." General Railway Signal Co. September 27th, 1932. (419401.)

27912. "Electrical devices for the heating of rooms." E. Runte. October 12th, 1932. (Cognate application 27913/33.) (Addition to 415047.) (419331.)

29214. "Electric amplifying devices in sound-film installations." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 14th, 1932. (419405.)

29367. "Method and device for recording the work of arc welders, and in general, of workmen utilising an electric welding circuit." R. Sarazin. October 22nd, 1932. (419235.)

29613. "Contacts of electrical switches, circuit-breakers, isolators or connectors." G. A. Juhlin and Associated Electrical Industries, Ltd. October 25th, 1933. (419406.)

31699. "Arrangement for the current supply of an a.c. sound-signal apparatus from a d.c. system." A. Lenkel. November 18th, 1932. (419335.)

33151. "Devices for the decomposition and composition of pictures, particularly in television." I.M.K. Syndicate, Ltd. November 26th, 1932. (Addition to 394446.) (419120.)

36633. "Switching arrangement or lighting installations." B. C. W. Hagelin. December 29th, 1933. (419173.)

1934

382. "Electrical cable and method of manufacture." General Cable Corporation. May 25th, 1933. (419175.)

3048. "Electrodes for alkaline accumulators." Alklum Storage Batteries, Ltd., and B. M. Berg. January 30th, 1934. (419183.)

3171. "Apparatus for analysing objects by ultra-violet rays." Dr. K. G. Stern. May 6th, 1933. (Cognate application 3172/34.) (419121.)

3324. "Electric fuses." V. Hope. February 1st, 1934. (419242.)

5891. "Telephone installations." F. Merk and H. Fuld and Co., Telephon-und Telegraphenwerke Akt.-Ges. February 25th, 1933. (Addition to 4996/33.) (419189.)

8697. "Thermometer or thermal-electric switch." J. A. G. Dennis and J. Algar. March 20th, 1934. (419195.)

9726. "Electrically-operated alarm installations." H. A. Gill (Elektrozeit Akt.-Ges.). March 28th, 1934. (419198.)

9822. "Operation of adjustable electrical elements in electrical signalling apparatus." Ideal Werke Akt.-Ges. für Drahtlose Telephonie. March 29th, 1933. (419199.)

10535. "Ventilating fans for electrically-driven hand tools." R. Bosch Akt.-Ges. April 12th, 1933. (419252.)

10935. "Electric sound recording and reproducing devices." P. C. Ricchiardi and L. P. Durand. April 11th, 1933. (419253.)

14175. "Electric transformers." British Thomson-Houston Co., Ltd. May 10th, 1933. (419260.)

14697. "Television or like systems." Fernseh Akt.-Ges. May 15th, 1933. (419419.)

18846. "Circuit arrangements for gasfilled electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 4th, 1934. (419271.)

20122. "Means for quenching arcs in electric circuit-breakers." British Thomson-Houston Co., Ltd. July 7th, 1933. (419274.)

21253. "Pot-heads for multiple-core electric cables." G. Herbert, F. J. Flint and C. F. D. Venning. July 20th, 1934. (419278.)

23667. "Cathodes for electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 7th, 1933. (419352.)

24752. "Rolled electrolytic condensers." Telegraph Condenser Co., Ltd., P. A. Sporing and F. C. Stephan. August 28th, 1934. (419430.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 28th :—

Autoflex. No. 548224. Class 6. Road traffic signalling machinery.—Siemens & General Electric Railway Signal Co., Ltd., Caxton House, Tothill Street, Westminster, S.W.1.

Frigidine. No. 554857. Class 6. Electrically operated machines for plucking eyebrows.—Frigidine Products, Inc., New York. (British representatives: T. B. Browne, Ltd., 163, Queen Victoria Street, E.C.4.)

Lion H.T. Battery; Full of Lasting Energy (lettering and design). No. 545634. Class 8. Electric batteries (not for medical purposes).—Vinces Dry Batteries, Ltd., Lion Works, Garford Street, E.14.

Utilo. No. 553517. Class 18. Engineering, architectural and building contrivances.—Edmundson's Electricity Corporation, Ltd., Broad Sanctuary Chambers, Tothill Street, Westminster, S.W.1.

Nilcrodium. No. 552173. Class 50. Articles made from a thermo-plastic moulding composition having a bitumen base from phenol formaldehyde condensation products or from similar thermo-plastic moulding compositions.—Pritchett & Gold & E.P.S., Ltd., 50, Grosvenor Gardens, Westminster, S.W.1.

Atmospheric Pollution

Thirty-two representatives of local authorities and other organisations co-operating with the Department of Scientific and Industrial Research in the investigation of atmospheric pollution met recently in their half-yearly conference and received a report from Dr. G. M. B. Dobson on the progress of the work carried out under the Atmospheric Pollution Research Committee. Dr. Dobson stated that the new method which had been developed at the Building Research Station for estimating sulphur in the atmosphere was now being used at twenty-seven stations. It was hoped that it would be adopted still more widely by local authorities, as it gave, with little expense, information of great value concerning one of the most destructive of atmospheric impurities. He also referred to trials which were being made of a photo-electric method for recording daylight. If successful, this method would provide a virtually automatic means for measuring the amount of the sun's ultra-violet light cut off by smoke haze.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Airdrie.—Houses (98); burgh surveyor.
Amersham.—Telephone exchange, Little Chalfont, for H.M. Office of Works, King Charles Street, London, S.W.
Askham Bryan (YORK).—Farm institute (£88,185), for Yorkshire Council for Agricultural Education.
Bedfordshire.—School, Harrold, for County E.C.; director of education, Bedford.
Bingley.—Houses (60), Eldwick; Glen View Estate Co.
Birkenhead.—Houses, Church Road and West Drive, Upton; A. E. Shennan.
Birmingham.—School, Beeches Road, Perry Barr, for E.C.
Blackpool.—Town hall scheme, Central Station site (£1,000,000); borough surveyor.
Bradford (YORKSHIRE).—Houses (83), Great Horton Road and Holly Bank Road; F. Wray, junior, builder, 161, Dirkhill Road.
Brierley Hill.—Houses (48), Manor House site, Kingswinford, and 30 houses at Brockenmoor; U.D.C. surveyor.
Carlisle.—Central schools for E.C.
Chailey (SUSSEX).—Houses (48); R.D.C. surveyor.
Chelmsford.—Houses, New Writtle Street; Fred. Taylor & Co., estate agents. Five schools for Borough E.C.; director of education.
Chesterfield.—Automatic telephone exchange, Brookside; G.P.O. Telephone Department.
Connah's Quay.—Houses (122), Kelsterton; J. Garrett, housing architect.
Coventry.—New works for Modern Machine Tools, Ltd., Butts Works.
Doncaster.—Extensions, Yorkshire Institution for the Deaf (£22,000); Walter Firth (Doncaster), Ltd., builders.
Dover.—Block of flats (£14,574); borough surveyor.
Durham.—Colony for the mentally defective to School, Aycliffe, for C.C. (£120,000); Rees and Holt, architects, 64, Rodney Street, Liverpool. School (£25,000), Crook; F. Willey, architect, 34, Old Elvet.
Easington.—Houses (262); C. W. Clarke, R.D.C. surveyor.
Eastbourne.—Houses (28), Churchdale Road; Prospect Houses, Ltd. Houses (247), Hydneye Estate, Hampton Park; Oliver & Leeson. Church, Victoria Drive; P. D. Stonham & Son, architects.
Eccles.—Houses (80), Haddon Road Estate; borough engineer. Houses, Leamington Road, Winton, &c.; T. H. Mitchell, Ltd.
Edinburgh.—Houses (108), Granton Mains; city architect.
Epsom.—School of art, library and museum; U.D.C. surveyor.
Erith.—Chemical works; Imperial Chemical Industries, Ltd.
Essex.—Junior school, Tilbury (£16,036), for County E.C.; Hosking & Son, builders, Rayleigh.
Finchley.—Houses (24), Linden Lea and Lytton Close, Hampstead Garden suburb; W. L. M. Estates, Ltd. Cinema and shops, High Street, N.12; Herga Construction, Ltd.
Flegg.—Houses (27); R.D.C. surveyor.
Folkestone.—Houses (40), Radnor Street; E. L. Allman, borough surveyor.
Gainsborough.—Factory and foundry for James Marshall & Partners, electrical work; T. Tatam, architect; B. Pumfrey, Ltd., builders.
Gerrard's Cross.—Telephone exchange; Room 65d, Third Floor, H.M. Office of Works, London, S.W.1.
Glamorganshire.—Schools (£200,000), for C.C.
Glasgow.—Houses (32), Montrave Street; housing director. Houses, Balornock, and libraries, Riddrie, Knightswood, King's Park and outlying districts; city engineer.
Gloucester.—Technical college for E.C.
Godstone.—Houses (24), Lingfield; R.D.C. surveyor.
Gravesend.—Houses (29), Central Avenue; H. L. Smith.
Hanley (STAFFORDSHIRE).—Arcade, &c., Piccadilly; J. Pepper.
Hastings.—Extensions to New Palace Pier (£120,000), for Southern Piers, Ltd.; D. Lannon, director.
Hereford.—Cinema and café, Commercial Street, for R. Maddox; A. H. Jones.
Hertfordshire.—School (500 places), Kingswood Estate, Leavesden, for County E.C.; director of education, Hertford.
High Wycombe.—School, Mill End Road, for E.C.
Hillingdon.—Houses (62), Oak Farm Estate; T. Blade, Jutsums Lane, Romford.
Horsham.—Houses (40), Roffey; U.D.C. surveyor.
Hucknall.—Houses (60), Washdyke Lane Estate; U.D.C. surveyor.
Huddersfield.—Reconstruction of business stores (£114,000), for the Industrial Co-operative Society; secretary.
Hull.—Houses (676), various housing schemes; City architect. Shops and offices, Alfred Gelder Street; M. Burton, Ltd. School, Mayburv Road; City architect.
Iver (BUCKS).—Factory, for Building Utilities, Ltd.
Keighley.—Houses (80), Woodhouse Estate; borough surveyor. Houses, Woodhouse Estate; borough engineer.
Kent.—Boys' and girls' schools (960 places), Northfleet, for County E.C.; director of education, Maidstone.
Largs (AYRSHIRE).—Cinema, Pier Head, for H. Kemp, Barrfields.
Leicester.—Houses (1,000), Baunstone Hall Estate (£400,000); R. H. Simmons, builder, New Road, Hinckley.
Lincolnshire.—Senior school, Immingham, for County E.C.; P. W. Birkett, county architect, Lincoln.
London.—(BERMONDSEY).—Shops, tenements, &c., Cherry Garden Street (£34,000); B.C. engineer.
Longbenton.—Houses (46); A. Best, architect, Seaton Delaval, Blyth.
Maidenhead.—Extensions to municipal offices (£10,550), with electrical work; Lt.-Col. P. Johns, borough surveyor.
Manchester.—Flats (4,125) and houses, Bennett Street, Ardwick; L. Heywood, Housing Director, Town Hall. Buildings, Council estates (£50,000); city architect.
Melton Mowbray.—Extensions, War Memorial Hospital (£8,750); L. Moore, architect.
Middlesbrough.—Houses (134), Acklam Road; Kitching & Co., architects, 21, Albert Road. Houses (26); Dean Brothers, builders, Marton Road.
Middlesex.—School, Home Farm Estate, Hayes; County surveyor.
Morecambe.—Houses (24), Dallam Avenue; H. Hillman & Sons. Houses, Morecambe Road; Barrow Bros.
Newcastle-on-Tyne.—New premises (£25,000); Prudhoe Street and Park Place, for Morris & Jones; T. Clements & Sons, builders, Seolbourne Gardens.
Norham (NORTHUMBERLAND).—Houses (45), Shoreswood Hall Farm; J. Paterson, architect.
Northampton.—Houses (75), St. David's Estate; borough engineer. Baths, Upper Mounts site (£46,725); A. Glenn & Sons, Ltd.
Norwich.—Theatre, electrical work; Pitcher Construction Co., Ltd., builders, Ashburton Grove, London, N.
Nottingham.—Cinema, Mansfield Road, Carrington; W. Chell, builder, Albert Road, West Bridgford.
Orrell (WIGAN).—Houses (92), by direct labour; U.D.C. surveyor.
Padiham (LANCS).—Town Hall, public offices, library and slipper baths (£35,293); U.D.C. surveyor.
Petersfield.—Cinema, Chapel Street (£35,000); U.D.C. surveyor.
Portsmouth.—Market, Oxford Street and Staunton Street area (£66,000), for City Council.
Prestwich (LANCS).—Junior school, Besses-o'-th'-Barn, for E.C.; W. Smith, clerk.
Rochester.—Senior boys' school, Temple Farm Estate, Strood, for City E.C.; E. H. Webb, secretary, Corporation Street.
Ruislip.—School, Dawlish Drive, Manor House Estate (£18,520); Haymills, Ltd., Wembley Park.
Salford.—Public offices, Broughton Road (£17,300); Fearnley & Sons, Ltd.
Scarborough.—Houses (208), Prospect Mount Estate; Mollekin Bros., builders, Maltby, near Rotherham. Houses (208), Northstead Estate (£66,716); Mollekin Bros., Maltby, near Rotherham.
Sheffield.—Extensions to Firth Park Secondary School, for E.C.; city architect. Houses (52), Crimicar Lane and Hallamshire Road; J. W. Sivil, Ltd. Houses, Merton Lane; F. S. Bush. Houses (38), Prince of Wales Road and Halsall Road; E. & E. Sadler, Ltd.
Shropshire.—Senior school, Madeley, for County E.C.; A. G. Chant, county architect, 5, Belmont, Shrewsbury.
Smallburgh.—Public offices; F. M. Dewing, architect, Aylsham Road, Norwich.
Southampton.—Physics laboratory, University College (£20,000); Court of Governors. Extensions to Royal Hotel, with wing and ballrooms, &c. (£7,500), for Southern Counties Hotels (Southampton), Ltd.; S. W. G. Dear, secretary, 3, Albion Terrace.
Southend-on-Sea.—Two senior schools, Caulfield Road, Shoeburyness, for Borough E.C.; director of education.
Southgate.—Houses (45), Pasteur Gardens Estate; E. Pollex. Houses (34), Sheringham Avenue, Oak Lodge Estate; G. W. Newman. Cinema, The Bourne; Bertie Crewe.
South Hillingdon.—Elementary school (£31,708); W. S. Try, Uxbridge.
South Shields.—Houses (148), Wenlock Road, Tyne Dock; J. Reid, borough engineer, Town Hall. Cinema, Westoe; J. H. Morton & Sons, architects, Martin Bank Chambers, Fowler Street.
Staincross (YORKS).—Houses (38), Greenside site; U.D.C. surveyor.
Stirling.—Additions to County Offices, Viewforth (£38,000); county architect.
Stockport.—Aeroplane works, Heaton Chapel, for the Fairey Aviation Co., Ltd., Hayes, Middlesex.
Stoke Newington.—Blocks of flats, Stroud's Nursery, Clissold Road; J. Hodges.
Stoke-on-Trent.—Houses, Cornhill (No. 2) site; city engineer. Houses (97), &c., Hempstalls Lane, Wolstanton; Bournville Village Trust. Houses (28), High Street and Colclough Lane, Goldenhill; G. H. Wignall.
Surrey.—Central school, Molesey; county architect. Extensions to Warren Road Hospital and nurses' home, Guildford (£43,475), for the P.A.C.; clerk, Kingston-on-Thames.
Tarporley.—Houses; Mr. Coppack, U.D.C. architect, Chester.
Thirsk (YORKS).—Houses (52); R.D.C. surveyor.
Thurmaston.—Houses (130), Syston Road; U.D.C. surveyor.
Twickenham.—Houses (130), Crane Court Estate; G. H. Nicholls, architect, 2, The Broadway, Stanmore. Houses (30), Ryecroft Avenue; George Heath (Builders), Ltd., Twining Avenue.
Uxbridge.—Houses (68), Avenue Housing Estate; Council's architect.
Wantage.—Houses (60); R.D.C. surveyor.
Warrington.—Factory, Wilderspool Causeway; J. Bennett & Co., Ltd. Houses, Alder Lane; borough engineer.
West Hartlepool.—Secondary school (£27,000) for E.C.; borough engineer.
Willenhall.—Houses (100); Clerk to Council, Town Hall.
Wiltshire.—County offices (£113,000), for C.C.; T. Walker, County architect, Trowbridge.
Workington.—Houses (60), Frostoms Estate; borough engineer.
York.—Extensions to Public Offices, The Castle (£50,000); city engineer.